THE

ELECTRICAL REVIEW.

VOL. LXXII. MAY 9, 1913. No. 1,850.

ELECTRICAL REVIEW.

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	Page
Marconi Contract: Advisory Committee's Report	749
The Coming Position in Turkey	750
"Local Representation Necessary"	751
Consulting Engineers in Germany	751
Constantinople Railways	751
Notes from Canada	752
Correspondence:—	
Prospects in Electrical Engineering	752
Long-Scale Instruments	752
Static Charges in Textile Mills	753
Omnibus Lighting	753
The "Point Five" Meeting (M.E.A. Convention Week), June 17th	753
Report of Royal Commission on University Education	753
Imperial Wireless System: Report of the Advisory Committee	753
Legal	755
Business Notes	756
Notes	765
City Notes	768
The Brompton and Kensington Electric Restaurant (*illus.*)	769
New Electricity Works at Fusan, Korea (*illus.*)	772
Stocks and Shares	779
Electric Tramway and Railway Traffic Returns	780
Market Quotations	780
Share List of Electrical Companies	781
Metal Market.—Fluctuations in April	783
Trade Statistics of South Africa	783
Proceedings of Institutions:—	
On Phase-Advancing (*illus.*)	784
Standard Clauses for Street Lighting Specifications	787
Birmingham's Proposed New Power Station (*illus.*)	789
New Electrical Devices, Fittings and Plant (*illus.*)	790
Parliamentary	791
New Patents Applied For, 1913	792
Abstracts of Published Specifications	792
Contractors' Column ... Advertisement pages xxvi and xxviii	

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MARCONI CONTRACT: ADVISORY COMMITTEE'S REPORT.

THE proceedings of the Select Committee on the Marconi contract have recently been subject to considerable criticism, and suggestions for a speedy conclusion of its labours have been freely offered. The time has not yet arrived for an impartial judgment, and the circumstances with which it has to deal are so exceptional that in the end some justification may be found for an unusual method of procedure. But whatever opinions may be held of recent sittings, credit must be given to the Committee for a recognition, at an earlier stage, of its limitations and a desire to obtain competent assistance. At the meeting on January 13th, it reported that it was unable to deal adequately with the technical features of the contract and desired the appointment of a scientific Committee, which should report thereon. The Advisory Committee, as we recorded at the time, consisted of Lord Parker (chairman), Mr. Duddell, Dr. Glazebrook, Sir Alexander Kennedy and Mr. Swinburne, with Mr. E. H. Rayner as secretary.

The appointments were made by the Postmaster-General. The terms of reference were: to consider and report on the merits of the existing systems of long-distance wireless telegraphy, and in particular as to their capacity for continuous communication over the distances required by the Imperial chain. It will be seen that the terms of reference are somewhat narrow, and it would have been possible to comply with them strictly and submit a report which would not be of much practical value under all the circumstances. But the eminent scientific members have evidently not overlooked the fact that science is "organised common sense," and the distinguished judicial member of the Committee has apparently borne in mind that it is not possible to answer every question by a simple affirmative or negative, and be sure that justice results. The provisions of the agreement are regarded as outside the terms of reference to the Advisory Committee, but the latter safeguards its position by stating: "but nothing we have said in this report must be taken as expressing our approval of such provisions." The common sense which recognises that the Committee's duties had relation to a really practical question characterises the report as a whole. The Committee took evidence upon known systems, and advertised with a view to ascertain whether there were any new inventions or improvements, the consideration of which might be useful. But apparently there are no budding systems of a retiring nature, or if so, their inventors are still hiding their lights under bushels, for the advertisement led to no useful result. Evidence was taken from representatives of the various systems, such evidence being given in private, and treated as confidential. A brief description of the plant required in terms which even a House of Commons Committee could understand leads to the remark that "the term

'system of wireless telegraphy' is not really apt," because the major portion of the buildings and plant could, with minor modifications, be used equally well with any high-frequency generator or other patented device. It is pointed out that each company or firm uses apparatus protected by its own patents, and has to avoid the use of apparatus protected by patents belonging to other companies or firms. Considerable attention is given to the matter of patents, as might be expected from a Committee whose chairman has had so wide experience of patent law. Some qualification may be necessary for the statement that "the existence of a patent may seriously interfere with the normal development of an industry," but with its application to the purpose under consideration, no fault will be found, for it is pointed out that a competent engineer, if asked to erect and equip the wireless chain in the most efficient manner, might desire to combine apparatus whose combination would be difficult if not impossible because of the existence of patent rights. And then follows a statement which has been made by critics of the contract, that the Government is not fettered by considerations arising out of patent rights, but can use any patent on fair terms under the 1907 Act.

The Committee has examined the various "systems" and describes in general terms their principal features. The companies or firms controlling these "systems" were invited to give practical demonstrations. It was in regard to these practical demonstrations over the required distance that evidence was lacking from all except the Marconi Co., but whilst recording the facts, the Committee thinks it right to state that, according to the information given, it was in several cases impossible to arrange for the demonstration within the short period which could be allowed for the purpose. Moreover, the Committee records the reported achievements of each system so far as evidence was produced, and does not lose sight of the possibilities or the good features attending each. Wireless telegraphy, in its opinion, is in a condition of rapid development, and the members commit themselves to the expression of opinion that this development will, in all probability, involve the ultimate substitution of continuous oscillations for spark discharges. But, leaving description or forecast, and dealing with facts and demonstrations, the Committee report that, according to its investigation, "the Marconi system is at present the only system of which it can be said with any certainty that it is capable of fulfilling the requirements of the Imperial chain," which is the answer to the "in particular" phrase of the terms of reference. But again the Committee wisely avoids the possibly misleading effect of such an answer if unqualified, for the qualification immediately follows in the words: "but this must not be taken to imply that, in our opinion, the Marconi Co. must necessarily be employed as contractors for all the work required for the Imperial chain."

The confidence which was felt in the *personnel* of the Committee on its appointment will only be strengthened by its report, the trend of which may be said to confirm the official view as to the superior facilities possessed by the Marconi Co. for carrying out the contract, but so far from being so impressed with that superiority as to make onerous terms with a company perhaps unduly confident of its superior position, the Committee thinks that in some respects it might "be better for the Government themselves to undertake the construction and equipment of the necessary stations, acting for that purpose under the best technical and scientific advice which can be obtained, and employing the most suitable contractors for the various portions of the work or plant." At the same time, recognition is given to the fact—or as the Committee expresses it, "it may be said, and s no doubt the fact"—that the Marconi Co. alone has had the practical experience in putting down stations, organising traffic and staff, and in coping with the difficulties that arise in a new industry, "and the value of such experience may well outweigh other considerations if rapid installation and immediate and trustworthy communication is desired." The value to be attached to such experience is of the essence of the controversy on the contract. That such exceptional experience at the moment should be paid for by a royalty upon the gross receipts for a long term of years gave rise to one of the foundation criticisms. The official evidence before the Select Committee indicated that the agreement contained ample provision for the termination of the royalty period. On the other hand, the omission of any reference to the possible earlier termination of the royalty in the circular to the shareholders was justified by the managing director, who held the view that in practice the royalties would continue. The Select Committee will probably be saved a great deal of trouble in determining this part of the contract by the report of the Advisory Committee. After recounting various features of wireless systems which are under development, or in a transition stage, the Committee expresses the opinion that it is "undesirable that in constructing and equipping the stations of the Imperial chain, the Post Office should be pledged to the continued use of any apparatus now used in any so-called system, or be subject to any penalty by way of continued royalties or otherwise for the disuse of any apparatus which may be installed in the first instance." It considers it imperative in any contract that may be entered into that complete liberty of action in this respect should be reserved. All the stations should be constructed with a view to possible and probably rapid developments of the art, and two should be used at once as experimental stations, in which suggested improvements may be thoroughly tested. Not content with suggesting that stations should be available for testing, the Committee goes further and dwells on the necessity of the department of the Government working the industry being willing to make such tests. There follows a paragraph which in character with the general tone of the report prevents any misunderstanding of a previous statement. "We have already referred," it says, "to the possibility that the existence of patents may fetter the normal development of an industry. A Government monopoly may stop its growth altogether, and is almost sure to do so unless the Government department which works the industry is ready to welcome and test any new invention and improvement, to adopt and use it if the test be satisfactory, and to pay for it on fair terms if adopted." On a subject so controversial as the Marconi contract, it is not impossible to conceive that some may regard such an *obiter dictum* as outside the terms of reference to the Committee. We should not be disposed to argue that point, but we should say that it is due to the practical common sense of the Advisory Committee that we have a report (appropriately dated from the Royal Courts of Justice) that will be of real assistance in determining the practical solution of a question which involves the progress of science as well as of public and private rights.

The Coming Position in Turkey.

Naturally enough, the trade of Turkey has been greatly interfered with for some time past, and exports from the United Kingdom during 1912 were lower than in either of the two preceding years. Our imports from Turkey, on the other hand, were the highest on record since 1897, the chief increases being in barley and raisins. In the annual report of the British Chamber of Commerce of Turkey there are given numerous detailed figures which are likely to be of interest to anybody who wants accurately to gauge the position of affairs. The Chamber says that without making rash prophecies regarding the future of the country and the territories likely soon to become part of the Balkan States, both belligerents "may yet surprise the world with their powers of recuperation." It is noteworthy that during the war there have been few cases of

suspension of payment in Turkey, and financial houses have experienced little loss. "The Government has kept its financial obligations with scrupulous exactitude, and has never for a moment broken faith with the creditors of the State." We reprint from the report the appeal of the Chamber to British manufacturers and traders to assist in securing a greater British hold on the market :—

It would please us to see our countrymen look this way and take a part in the developments that must take place as soon as peace is restored. Turkey, as well as the Balkan States, are bound to undertake public works of all kinds in order to promote the well-being and the security of these territories, sadly lacking in the elementary necessities of modern civilisation. We hope that Great Britain will not lag behind or fail to profit by the opportunities which will present themselves to capitalists and industrialists.

Earlier in the same report there is a warning to "home firms" not to be content with representation by "undesirable agents." The Chamber has itself in cases recommended important firms to make changes, having found that though their goods are appreciated on the market, they are doing unsatisfactory business "through incompetent or unscrupulous agents." Unfortunately, the Chamber has occasionally been appealed to respecting such matters when it has been too late, serious mischief having been done. We congratulate the Chamber on the growth of its membership (from 303 to 356) during 1912, following upon an advance from 244 to 303 in the previous year. Further comment upon some of the effects of the disturbed state of the country was made last week in the report of the Constantinople Telephone Co., the closing sentences of which show that the company is already taking appropriate measures for securing other concessions for establishing telephonic communication elsewhere in the Ottoman Empire. It is almost superfluous to suggest the wisdom of taking equally prompt and far-seeing action respecting other kinds of electrical and engineering undertakings and work in the same country.

Constantinople Railways.

It is of interest, in connection with the above comments, to note that a company has now been formed in Constantinople under the title of the Société Ottomane des Chemins de Fer Métropolitain de Constantinople for the purpose of working the concession granted to the group headed by the Deutsche Bank for the construction and operation of an underground network of railways in the Turkish capital. The ordinary share capital amounts to £1,400,000 divided into 70,000 £20 shares, all of which have been subscribed and a first instalment of 10 per cent. has already been paid. As the undertaking is expected to involve an expenditure of £2,800,000, it may be assumed that the difference between this amount and that of the ordinary capital will be raised by the issue of bonds. The directors include representatives of the German Orient Bank, the Imperial Ottoman Bank, the Hungarian General Credit Bank, the Société Centrale pour l'Industrie Electrique of Paris, the Société Financière de Transports of Brussels, the Electric Light and Power Investment Co. of Berlin, &c. In addition to the main line, the concession places upon the holders the obligation to construct three branch lines, and the former has to be completed within 4½ years. The company will have to pay to the city authorities a sum of £806 per annum per mile of railway in operation and a further sum is payable for the expenses of the Imperial commissariat. The concession is for a period of years extending to 1993, but the Government reserves the right of acquiring the undertaking at any time after the expiration of 30 years.

Apart from this enterprise, it may be remembered that a concession has also been granted to the firm of Lenz & Co., of Berlin, in association with the A.E.G. for the construction of the so-called Bosphorus electric railway. As the two railways would compete with each other over a short distance, negotiations are in progress with a view to bringing about a mutual understanding so as to obviate any rivalry.

"Local Representation Necessary."

Readers who, either as a matter of general interest or in search of business opportunities, make a study of the mass of contract information that we put before them in the course of a year will have observed somewhat frequently how they are debarred from tendering unless they qualify by "local representation." From the point of view of the country calling for the work, the limitation thus imposed upon outsiders may be perfectly reasonable, and it is useless girding at it. We have got to fall in with it whether we like it or not, or else lose the chance of doing business with Government Departments and public undertakings in certain countries. The stipulation is imposed by Scandinavian authorities and by Spanish, but, as though with a desire to prevent a desirable tenderer from dismissing the matter precipitately, there is a hurriedly added clause indicating that such local representation need not be personal, but may be through a native agent.

There are often business possibilities justifying the appointment of such agents, where a branch would not appear to be warranted. But it is not only European countries that impose such limitations as we have indicated above. Our own Colonies are increasingly impressing upon us the need for efficient representation "on the spot," and in some cases they actually insist upon it. The reasonableness of being right there to secure business has been realised by a number of our British electrical firms, but it may be that those who have failed to adopt the advice when it has been given by Consuls, trade experts, and by our humble selves, may find it easier to repent in presence of Colonial and foreign compulsion.

The *British and South African Export Gazette* has something to say on the matter, basing its observations upon the announcement by the Durban municipality expressly stipulating for local representation by tenderers for electric meter-testing equipment. Our contemporary points out that there is no lack of choice among the many South African firms of high repute, and a suitable qualifying arrangement might be made with one of these in the absence of ability to have one's own branch. We have many times regretted the shortness of time allowed for firms to tender for Colonial contracts, and we believe that there has been some improvement, but as time goes on will it be reasonable to expect public authorities to inconvenience themselves by allowing longer than is actually necessary? The demand for attendance on the spot must, it seems to us, increase rather than decrease, and we have got to see that our representation is up to such a standard of efficiency that it will make the clinching of bargains possible without reference home, and in face of foreign competitive methods. But we have said this *ad nauseam*—yet we must say it again.

Consulting Engineers in Germany.

The position of consulting engineers in Germany cannot be a very happy one, if credence is to be attached to a statement made in the Prussian Diet in the course of the proceedings on April 19th, in connection with the second reading of a Government Bill to authorise the conversion to electric traction of the Berlin City and Circle railways. As is known, the Bill had previously occupied the attention of a commission, whose proceedings were private, although an official report in a brief form was issued at the termination of each day's sitting, summarising the general course of the deliberations. The commission called for and heard expert evidence on the proposals for electrification of the railways in question, but the names of the witnesses have not been disclosed. The reason, according to the statements made in the Prussian Diet by Herr von Pappenheim, is quite simple, although showing a surprising state of affairs. When the experts were examined by the commission, and were asked to intimate their opinions, they almost invariably expressed the wish that the attitude they assumed should not be allowed to be made public, and that their names should also be withheld, as they feared that they would have to suffer injury in the further progress of their science and profession from those at the back of the Government scheme. Commenting on this statement, a Berlin newspaper remarks that affairs have thus so far advanced in the electrical industry that experts outside of the large undertakings apprehend personal disadvantages if they express opinions which differ from the business interests of these undertakings!

NOTES FROM CANADA.

[FROM OUR OWN CORRESPONDENT.]

The Calgary Power Co. is developing another water-power on the Bow River at Kananaskis Falls; it is intended that this shall be run in parallel with the existing plant at Horseshoe Falls. The output of the new plant will be about 12,000 H.P., under a 70-ft. head, as there will be two 6,000-H.P. turbines coupled to two 5,100-K.V.A. 12,000-volt three-phase generators.

The town of Kamloops, B.C., has decided to spend £50,000 on a hydro-electric plant, and £13,000 in improving and extending the electric lighting system.

The Industrial Commissioner of Ottawa has just issued a map showing, among other things, the water-powers within a radius of 60 miles of the city; these are estimated to be capable of developing a minimum (at low water) of 2,300,000 H.P., and it is stated that 150,000 H.P. is at present developed.

The Toronto newspapers have lately been full of discussion of the question as to whether the city should buy the Toronto Street Railway Co. and the Toronto Electric Light Co., both of which are owned by the Mackenzie & Mann interests. A short length of municipally owned tramway has already been in operation for a few months, and other sections now under construction will be ready before long.

The idea of purchasing the Street Railway Co.'s equipment is with a view to the unification of the city's transport facilities, which, owing to the rapid growth of Toronto, fall far short of providing an efficient service for the thousands of persons wishing to use the trams; this results in the cars being dangerously overcrowded to an extent which would not be tolerated for a moment at home.

The Ontario legislature passed a Bill a few days ago, empowering the Hydro-Electric Power Commission to investigate and report upon the cost of constructing and operating electric railways in any locality where power is supplied by the Commission.

Municipal corporations may be authorised to enter into an agreement with the Commission (1) for the construction, equipment and operation of an electric railway, to be operated by power supplied by the Commission; (2) for its construction by the Commission, and for its operation by the municipality; (3) for its construction and operation by the corporation or corporations, and in either case for the supply of electric power by the Commission, which body will control rates, character of service, equipment, and location of lines. The whole burden of cost will fall on the municipalities interested.

It will be remembered that some weeks ago these "Notes" contained the information that the representatives of a number of towns had met together and passed a resolution calling upon the Hydro-Electric Power Commission to investigate and report upon the subject of electric railways for the Province. The foregoing is the outcome of that resolution. There can be no question that such light radial lines as are contemplated would be a very great boon if they could be made a commercial success. The small towns and villages desire to have better communication with the big cities, both for pleasure and profit; the big cities, especially Toronto, are greatly in need of such communication, in order that the produce of farmers and market gardeners may be more expeditiously and cheaply brought thereto. Owing to bad roads, at certain seasons of the year it is practically impossible for many farmers and others to get their produce into the large markets, while, on the other hand, prices in those markets are excessive, owing to the shortage thus caused. The radial railways would benefit the whole community.

Strike.—A Leicester newspaper says that the strike of electricians there for higher wages is causing little inconvenience to the trade, as sufficient men are at work to keep things going. It is said that only 28 employés are out. Another paper said last week that five local firms and 70 men were affected, and that firms outside the E.C.A. had agreed to the advance from 8½d. to 9d. per hour.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Prospects in Electrical Engineering.

In reference to Mr. Alderton's reply to my letter of the 11th ult., kindly allow me to state that the same is a mean, cowardly, and illogical attack. Mean because it is all assumption without any reasonable ground, cowardly because my letter does not allude to any personal grievances in particular, and illogical because in the lines to which he refers I deal with two classes of individuals and obviously cannot be likened unto both, and, again, because in his argument he assumes his premise, then takes it for granted and draws his conclusion, which is absurd.

In regard to my lack of ability to discriminate between appointments having probabilities and those having possibilities, I suggest this is merely "bluff," but, in any case, although his advertisement is made use of as a typical example, my remarks are applicable in numerous other instances.

If Mr. Alderton will only take the trouble to read intelligently my second letter in this week's issue of the REVIEW on the above subject, especially the last paragraph, he will observe that I am not the type of engineer he, for the sake of argument, assumes me to be.

A. C. Black,
Hon. Sec., A.E.S.E. (Liverpool District).

Bootle, *May 5th*, 1913.

Long-Scale Instruments.

Referring to Mr. Davies's letter which appeared in your issue on April 18th, I am sorry he did not confine himself to history. He writes, however, in what he believes to be the cause of justice, and then proceeds to discredit my patents.

Where the inferred injustice lies, it is somewhat difficult to see, and also why he is interested in taking up the cudgels on behalf of the other firms who, he states, are "manufacturing these instruments," as they have the same channels open to them as my firm for making known their goods.

But who are these others whose cause Mr. Davies champions? Readers will acknowledge that until my company introduced long-scale instruments for direct current they were comparatively unknown.

As for himself, Mr. Davies has no cause to feel aggrieved, since he has had 20 years' *start* in which to develop his instrument, and with all the knowledge at his disposal, it is surprising that his instrument is not now the most popular instead of being of mere historic interest.

It is also interesting to note that Mr. Davies did not deem it worth while to continue his patent for more than six years. The Thompson patent which he quotes was also allowed to expire in nine years; therefore, had these patents been all that could be desired, it is strange it was left to me to produce the first commercial and practical instrument.

Mr. Davies, in his letter, refers to his statement in the *Philosophical Magazine* for August, 1899, that he had "arranged for the active use of even three sides of the coil," but he omitted to mention that in the same article he stated "but it has the rather serious disadvantage of being complex in design and—I am afraid—difficult to build."

I am more than surprised that Mr. Davies, with all his experience, should fall into such a blunder as to look upon the gap in my instrument as a constructional necessity. Furthermore, it is to be regretted that he did not choose from amongst my patent drawings a more representative sketch of my instrument, especially as he appeals to engineers to observe the gap, which he did not reproduce in his illustration.

As for the attack on my patent claims, what I claim and what I do not claim are open for anyone to read who cares to consult the patent specifications, so I do not propose to

discuss the "dignity of the claims" here; there are other places where they can be argued to greater advantage.

In conclusion, perhaps I may be pardoned for adding that several eminent engineers and instrument makers who have seen my instrument, have been sportsmen enough to admit that I have succeeded where others, including themselves, have failed.

The Record Electrical Co., Ltd.,
J. Westmoreland Record.

London, S.W., *May 3rd*, 1913.

Static Charges in Textile Mills.

I should be much obliged if any reader could give me some information regarding a method of neutralising electric charges which are formed on silk or woollen materials during the process of manufacture. I believe apparatus has been brought out for dealing with this trouble in paper mills. Names of firms manufacturing apparatus for this purpose would also be esteemed.

Static.

Omnibus Lighting.

I am operating some direct-current petrol-electric motor-omnibuses of the Tilling-Stevens type, in which the dynamo varies from a minimum of 15 v. to a maximum of 350 v. I should like, if possible, to be able to get the lighting on the vehicles from the dynamo, rather than have to put in a small one of the usual car-lighting type.

I shall be glad to learn if any of your readers know of a system that is adapted for this purpose. Of course, I do not expect the lighting to be done without a small storage battery, which would have to be connected in some way with the main supply.

Enquirer.

The "Point Five" Meeting (M.E.A. Convention Week), June 17th.

I have been asked to make it quite clear as to the persons entitled to attend the above meeting. On behalf of the Association, I would like to say that it was the wish of our members at the Bradford meeting that any persons interested in pushing the use of electricity for domestic purposes would be welcomed, whether technical men or laymen. Manufacturers will be specially welcome.

In order that the Committee may make arrangements for the place of meeting, it is necessary that all who propose to attend should let me know not later than May 22nd.

A. Hugh Seabrook,
Hon. Secretary.

London, W., *May 2nd*, 1913.

Report of Royal Commission on University Education.

One would have thought that engineering was a sufficiently important subject to have a faculty all to itself, for even music has a separate faculty. At present engineering is a sort of excrescence of Science. The Commissioners propose that it should be mixed up with something else, and the compound called "Technology," so that if this should ever come to pass some of our distinguished engineers will be able to state that they have the D.Ts. (*i.e.*, that they each possess the degree of Doctor of Technology)!!! "which," as Euclid would have said, "is absurd," and being absurd, it cannot be. Therefore let us have a separate faculty for the important subject of engineering, and let the degrees be B.E. and D.E. (Bachelor and Doctor of Engineering), which would be understood by the man in the street.

A. S. E. Ackermann, B.Sc. (Engineering).*

* Note our present clumsy degree! The abbreviation (save the mark!) is official.

IMPERIAL WIRELESS SYSTEM: REPORT OF THE ADVISORY COMMITTEE

The Committee appointed by the Postmaster-General consisted of:—The Right Hon. the Lord Parker of Waddington (chairman); W. Duddell, Esq., F.R.S.; Dr. R. T. Glazebrook, C.B., F.R.S.; Sir Alexander B. W. Kennedy, F.R.S.; and J. Swinburne, Esq., F.R.S., with E. H. Rayner, Esq. (secretary).

The Report, which is dated April 30th, 1913, is abstracted below:—

Immediately after our appointment we took measures to ascertain what systems of wireless telegraphy there were in existence, and by whom such systems were controlled. These systems appear to be the following:—(1) The Marconi, controlled by the Marconi's Wireless Telegraph Co., Ltd.; (2) The Telefunken, controlled in this country by Messrs. Siemens Bros.; (3) The Poulsen, controlled in this country by the Universal Radio Syndicate; (4) The Goldschmidt, controlled by the Anglo-French Wireless Co.; and (5) The Galletti, controlled by the Galletti's Wireless Telegraph and Telephone Co.

It appears, however, that the Admiralty, while in the main making use for communication between His Majesty's ships and shore stations and between ship and ship, of apparatus similar to that employed by the Marconi Co., claim nevertheless to have introduced important improvements. These improvements may be of some materiality; for the Admiralty desire that each station in the proposed chain shall be capable of communicating with His Majesty's ships. It should be considered, therefore, whether any system adopted by the Post Office for the purposes of the Imperial chain ought not to be capable of being worked in conjunction with the Admiralty appliances, especially as to the wave-lengths to be employed.

We have heard evidence on 11 days. We have also personally visited and inspected the several stations and works mentioned in the Second Schedule to this Report.

The term "System of Wireless Telegraphy" is not really apt. Each company or firm engaged in working a wireless station uses apparatus protected by its own patents and has to avoid the use of apparatus and devices protected by the patents belonging to other companies or firms. The main differences in the apparatus and devices at present in use centre in the high-frequency generator; but there are other apparatus or devices protected by patents, such as special aerials, different types of automatic high-speed transmitters and of receivers and recorders. Any company or firm which makes use of apparatus or devices which others are precluded from using because of the existence of some patent may claim to have its own system of wireless telegraphy, but the term "system" is misleading, inasmuch as by far the major portion of the buildings and plant could with minor modifications be used equally well with any high-frequency generator or other patented device.

The existence of a patent may seriously interfere with the normal development of an industry, for it tends to prevent the general use of the means best adapted for securing the end in view. It may well be that a competent engineer, if asked to erect and equip in the most efficient manner a chain of wireless stations such as the Post Office contemplates, would desire to combine apparatus, the combination of which is difficult if not impossible because of the existence of patent rights. In this connection we desire to lay stress on the fact that the Government is not fettered by considerations arising out of patent rights, but can use any patent on fair terms under Sec. 29 of the Patents and Designs Act, 1907.

Subject to the above criticism on the use of the word "system," the existing systems of wireless telegraphy may be divided into two classes according to the type of high-frequency generator used. In the first class, the production of high-frequency currents depends on spark discharges giving groups of oscillations and therefore intermittent trains of ether waves. In the second class, the generator produces oscillations which for practical purposes may be treated as continuous, and therefore as giving continuous ether waves.

To the first class belong the Marconi and Telefunken systems, and to the second class the Poulsen, the Goldschmidt and possibly the Galletti systems.

The Poulsen high-frequency generator is a modification or development of the singing arc fed by direct current.

The Goldschmidt high-frequency generator is a dynamo, giving an alternating current of a fundamental frequency of the order of 10,000 periods per second. The frequency is increased by the use of suitably tuned oscillation circuits, each successive circuit adding the fundamental frequency of the machine.

The Galletti generator involves a series of spark gaps arranged to operate in a cycle, so that the discharge of each causes, and is immediately followed by, the discharge of the next in the series, the sequence of discharges being so rapid that the resulting oscillations may be viewed as practically continuous.

Though at present making use of generators depending on spark discharges producing groups of oscillations, both the Marconi Co. and the Telefunken Co. are developing and experimenting with generators of their own, producing continuous oscillations. The Marconi continuous high-frequency generator consists essentially of a rapidly rotating contact-maker in a direct-current circuit, with special dispositions of other circuits to give continuous oscillations in the aerial. The Telefunken continuous high-frequency generator consists of an alternator constructed to give as high a fundamental frequency as may be convenient in the first instance, the frequency being doubled or quadrupled by a polarised transformer method. In making use hereafter of the term Marconi system or Telefunken system, we do not include either of these generators.

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In order to test the efficiency of the various systems to which we have referred for the purposes of the Imperial chain, we invited the companies or firms by which these systems are controlled to give us practical demonstrations thereof, if possible on a commercial scale, and if possible over distances of 2,000 miles and upwards. Except in the case of the Marconi system we did not, however, obtain any demonstrations on a commercial scale, or any demonstration over a distance of even 1,000 miles. It is right, however, to state that, according to the information given to us, it was in several cases impossible for the companies concerned to arrange for the demonstration as desired within the short period which we could allow for the purpose.

In order that we might test the Marconi plant at Clifden, the Postmaster-General permitted us to avail ourselves of the services of a small staff of skilled operators, who stayed there for a complete week, keeping continuous watch on the actual commercial working between Clifden and Glace Bay, and reporting to us very fully. These reports, for which the Committee acknowledge their indebtedness to Mr. S. E. J. Burrow and his assistants, contain full and valuable evidence as to the commercial working of the plant now in use.

We then went to Clifden, and the Marconi Co. put the station at our disposal. Through the courtesy of the Canadian Government, we were represented at Glace Bay by Mr. C. P. Edwards, general superintendent of the wireless service of the Canadian Government, who had the assistance of one of his operating staff. Mr. Edwards was provided with a number of sealed messages by our secretary, and he was instructed to open and superintend the transmission of these when and as requested by the Committee at Clifden, and to take charge of similar messages sent from Clifden to Glace Bay, and to send them by post to the secretary. Mr. Edwards made reports and comments from time to time during our visit, and dispatched a detailed account to us later.

The Marconi Co. use at their Clifden station a high-frequency generator, in which condensers charged from the high-tension batteries are discharged by projections which are fixed on a rapidly rotating wheel, and which pass close to metal disks on each side of it. Each discharge produces a group of high-frequency oscillations in a primary circuit, according to the company's usual practice. We observe that, for the purposes of the Imperial chain, they proposed to charge the condensers from an alternator through a high-tension transformer, as is their practice elsewhere, including the long-distance station at Coltano. This method is, in our opinion, preferable.

At Clifden the Marconi Co. use their directive aerial; and they have a second separate station for receiving from Glace Bay without being disturbed by the simultaneous sending at Clifden. They demonstrated duplex working while we were at Clifden and Mr. Edwards was at Glace Bay, all interference of the outward waves being eliminated, though the strength of the received signals was somewhat reduced.

The Marconi Co. is, we are satisfied, working on a commercial scale between Clifden and Glace Bay, a distance of about 2,300 miles, though at present the number of messages transmitted either way is not so great as to require duplex working or high-speed transmission. We were, however, present when messages were transmitted automatically at the rate of 60 words (of five letters) a minute, and we see no reason why this rate should not be considerably increased if it becomes necessary. The communication is practically continuous, though there are, no doubt, periods when the signals become very weak, and even occasional periods when no signals can get through. Periods of this nature are due to natural conditions, and will be incident to the working of any system. During such periods communication can, in our opinion, be ensured only by the use of great power in the aerial. We understand that for this reason, and having regard to the increased power required for high-speed transmission, the Marconi Co. proposed to employ for the Imperial stations practically double the power now used at Clifden. Even so we think there may be periods when communication is impracticable, especially in tropical regions where atmospheric disturbances may be expected to cause more difficulty than over the Atlantic.

With regard to the Telefunken system, which, like the Marconi, is largely used, its practicability on a commercial scale for distances of 2,000 miles has not yet been proved. Experiments are now being made between Nauen and Togo, a distance of 4,000 miles, and the results indicate that communication over this distance is already possible at night.

With regard to the Poulsen system, we are satisfied that it is practicable for short distances. The Poulsen arc has been tried between San Francisco and Honolulu, a distance of about 2,100 miles, but as to its practicability over this distance we have no evidence except that which was in the possession of the Post Office long before our appointment. The results obtained do not appear to have been very satisfactory. In our opinion the power used was insufficient. No one tendered any evidence on behalf of the company which is working between San Francisco and Honolulu, and the firm controlling the system in this country was apparently in ignorance of how it is now working in America. We have recently been informed of important experiments between Arlington and the U.S.S. ship *Salem* and between Arlington and Gibraltar, using both the ark and spark transmission; but full details are not yet before us. We conclude that if the Poulsen system is to be so developed as to be practicable for commercial purposes over distances of 2,000 miles or upwards, the arc will have to be constructed so as to supply the aerial with higher power, or use will have to be made of a more sensitive receiver.

Similarly, with regard to the Goldschmidt system, it is no doubt successful over short distances, and the only thing required to make it practicable over long distances is a machine of the necessary power. When the Goldschmidt station near Hanover and the corresponding station on the other side of the Atlantic are complete and in working order, we expect that communication between them will be established by the use, either alone or in conjunction with improved receiving apparatus, of the Goldschmidt machine which we inspected at the station near Hanover, and which was admirable both in design and workmanship.

Though continuous waves may be somewhat more efficient than intermittent trains of waves, and though the strength of the received signals may probably be increased by the use of improved receiving apparatus, we are of opinion that having regard to the experience of the Marconi Co., and in view of the demand likely to arise for high-speed transmission, it would be desirable in the first instance to insist on high powers for the Imperial chain whatever system be adopted. At present, with the exception of the Goldschmidt machine at the station near Hanover, we have seen no continuous high-frequency generator capable of putting into the aerial as much power as is put in by the Marconi Co. at Clifden for their trans-Atlantic service. We may add that both the Poulsen arc and the Goldschmidt machine are admirably adapted for high-speed transmission. Though we have not seen transmission by either at a higher speed than in the case of the Poulsen arc 70, and in the case of the Goldschmidt machine 60 words a minute, we have no doubt that these speeds could be increased. We have had no evidence as to the practicability of the Galletti system even over short distances.

We report, therefore, that according to our investigation the Marconi system is at present the only system of which it can be said with any certainty that it is capable of fulfilling the requirements of the Imperial chain, but this must not be taken to imply that, in our opinion, the Marconi Co. must necessarily be employed as contractors for all the work required for the Imperial chain. Indeed, in some respects it might, we think, be better for the Government themselves to undertake the construction and equipment of the necessary stations, acting for that purpose under the best technical and scientific advice which can be obtained, and employing the most suitable contractors for the various portions of the work or plant. On the other hand, it may be said, and is no doubt the fact, that at the present moment the Marconi Co. alone has had practical experience of the sort of long-distance work required, including experience in putting down stations, in organising the traffic and staff, and in coping with the difficulties that arise in a new industry, and the value of such experience and organisation may well outweigh other considerations, if rapid installation and immediate and trustworthy communication be desired.

Further, in our opinion wireless telegraphy is in a condition of rapid development, and this development will in all probability involve the ultimate substitution of high-frequency generators producing continuous oscillations, for high-frequency generators dependent upon spark discharges which produce groups of oscillations. Continuous oscillations should allow of more accurate tuning and greater selectivity, and may be better adapted for use in conjunction with improved receiving apparatus. The need of high-frequency generators producing continuous oscillations has long been felt by telegraph engineers, and has led to the various devices for the generation of continuous high-frequency oscillations to which we have already referred.

The only continuous high-frequency generator we have yet seen tried with success over long distances is the Marconi continuous high-frequency machine to which we have already referred. For the purpose of witnessing trans-Atlantic experiments with this machine we paid a second visit to Clifden and experiments were made with it in our presence. Using it Mr. Marconi, on the 26th and 27th of April, 1913, sent from Clifden to Glace Bay messages prepared by us for the purpose, such messages being at our request at once repeated from Glace Bay by means of the company's ordinary plant and correctly received at Clifden. The power put into the aerial by this machine for the purpose of the experiments was not sufficient for commercial purposes, but there seems no reason why higher power should not be obtained.

These experiments, in our opinion, warrant the belief that all or any of the devices for the generation of continuous waves to which we have referred may, at no distant date, be shown to be capable of successful use for the purpose of long-distance wireless telegraphy. Many engineering firms are also engaged in designing high-frequency alternators, and it seems probable that various other devices suitable for long-distance wireless telegraphy may shortly be available. Again, there is some evidence that the design of the aerial is in a transition stage. At present there are engineering difficulties in building perfectly satisfactory aerials for the longer waves which appear to be most appropriate to long-distance telegraphy. Aerials, especially high aerials, are frequently blown down or damaged by wind.

The directive aerial used in the Marconi system has the advantage of not requiring very great height and of giving preference in the desired direction. Its use in connection with the separate receiving station comparatively close to the transmitting aerial makes duplex working practicable. We see no reason why this form of aerial should not be capable of use with any form of high-frequency generator. Moreover, the development of the aerial may facilitate the use of still longer waves for long-distance work, and this may profoundly affect the problem of the high-frequency generator, by rendering possible the employment of simple alternators for the production of the frequency required, high though it must still be.

Receiving plant may take many forms. Thus the first receiver may be a crystal contact or some discharge valve on the lines of the Fleming valve, and this may work any one of various kinds of relay; and the record may be made by a Morse inker, by photo-

graphy, by a phonograph, by simple telephone or otherwise. There is a wide field here for experiment and development.

Having regard to these facts, it is, in our opinion, undesirable that in constructing and equipping the stations of the Imperial chain the Post Office should be pledged to the continued use of any apparatus now used in any so-called system, or be subject to any penalty by way of continued royalties or otherwise for the disuse of any apparatus which may be installed in the first instance. It is, we consider, imperative that in any contract which may be entered into, the Post Office should reserve complete liberty of action in this respect. Further, the stations should be constructed and equipped with a view to the possible and probably rapid development of the art, and we think it would be wise that at any rate two of the stations should be used at once not only for commercial purposes, but as experimental stations in which the various high-frequency generators hereinbefore referred to, and also any suggested improvement in any part of the apparatus, should as far as possible be thoroughly tested. This would involve the employment of a highly-trained staff with an engineer of special knowledge and of high standing at their head, but the information thus obtained would be invaluable for the construction and equipment or the improvement in the design of the stations.

Even when all the stations are constructed, equipped and in working order, we do not think it would be wise to cease using some of the stations for experimental purposes. We have already referred to the possibility that the existence of patents may fetter the normal development of an industry. A Government monopoly may stop its growth altogether, and is almost sure to do so unless the Government department which works the industry is ready to welcome and test any new invention or improvement, to adopt and use it if the test be satisfactory, and to pay for it on fair terms if it be adopted. For the purpose of testing, examining and, if necessary, further developing any new invention or suggested improvement in wireless telegraphy, a trained staff with an engineer of special knowledge and standing at its head will be necessary. Under the guidance of such a staff and engineer we see no reason why the Post Office wireless stations should not be ultimately equipped with apparatus far more efficient than that now used in any so-called system, more especially as the Post Office will be able to combine, in spite of existing patent rights, apparatus or devices which, because of the existence of such rights, cannot now be combined by anyone else.

We desire to add that the provisions of the agreement, now the subject of inquiry by a Select Committee of the House of Commons, are not, in our opinion, within the terms of our reference; but nothing we have said in this report must be taken as expressing our approval of such provisions.

SCHEDULE I.

Part I.—Names of Witnesses heard on behalf of the Companies or Firms interested.

Dr. R. Goldschmidt (Goldschmidt).
Dr. J. Erskine Murray (Goldschmidt and Poulsen).
Mr. Rappis (Galletti).
Mr. G. Marconi (Marconi).
Mr. Hird (Telefunken).
Prof. Pedersen (Poulsen).
Mr. Campbell Swinton (Poulsen).
Prof. Silvanus Thompson, F.R.S. (Poulsen).

Part II.—Names of Witnesses invited by the Committee to give evidence.

Vice-Admiral Sir Henry B. Jackson.	Commander Loring, R.N.
Commander W. R. W. Kettlewell, R.N.	Mr. H. A. Madge.
Lieut. D. W. Roe R.N.	Mr. J. E. Taylor.
Lieut. J. A. Slee, R.N.	Sir Oliver Lodge.

SCHEDULE II.—*Stations and Works Visited.*

Admiralty Station, Whitehall.
Admiralty High-Power Station, Horsea
H.M.S. *Vernon*.
Goldschmidt Station, Slough.
Marconi Station, Clifden, Ireland.
Messrs. Bergmann's Works, Berlin.
Messrs. Lorenz's Works, Berlin.
Telefunken Station, Nauen.
Poulsen Works, Copenhagen.
Poulsen Wireless Station, Lyngby.
Goldschmidt Station, Neustadt, Hanover
Post Office Station, Cullercoats.

LEGAL.

ALLIS CHALMERS CO. *v.* THE FIDELITY AND DEPOSIT CO., OF MARYLAND.

IN the King's Bench Division, Mr. Justice Phillimore, on May 1st, concluded the hearing of this action, brought by plaintiffs, manufacturers of electrical machinery, and carrying on business in the United States, London, Paris and elsewhere, against the defendant company, of Old Broad Street, E.C., the plaintiffs seeking a declaration that a fidelity guarantee bond for £1,000 was valid. Liability was repudiated by the defendants in regard to the bond.

Mr. H. E. Duke, K.C., and Mr. Lailey represented the plaintiffs, and Mr. L. Sanderson, K.C., and Mr. McCardie represented the defendants.

MR. DUKE stated that at the commencement of 1911 the plaintiffs established in Paris a separate office, and appointed as manager there Mr. A. C. Lochenies. Towards the close of 1911, having regard to large contracts the plaintiffs undertook, Mr. Keen, the plaintiffs' manager in Europe, considered it prudent to obtain a fidelity guarantee bond for Mr. Lochenies. In a communication to the defendants, they applied for a £1,000 bond. The defendants on March 5th wrote that the application for a bond for the £1,000 had been accepted by them at a premium of £6 5s., and that on the plaintiffs advising them that the rate of premium was accepted, the bond would be prepared and forwarded. Mr. Keen had occasion to go to America on a short visit, and the plaintiffs' London accountant asked the defendants in a letter to permit the question to remain open pending Mr. Keen's return. On April 18th that gentleman returned to London, and on that day his representative paid the premium and received the bond, which was dated March 8th. At the time the premium was paid (said counsel) there was a suspicion that Mr. Lochenies had left Paris. Mr. Keen went to Paris, and found that Mr. Lochenies had disappeared with the proceeds of a draft for a considerable sum. Mr. Keen wrote to the defendants, who replied alleging that they had been imposed upon, and were under no liability. Counsel proceeded to argue that the bond was issued on March 8th, and that, therefore, the defendants were liable in regard to it.

MR. SANDERSON, for the defendants, contended that the risk covered by the policy did not commence to run until the premium was paid, and that, as Mr. Lochenies had disappeared with money belonging to the plaintiffs before the payment was made, the defendants were not liable.

At the close of the evidence and legal arguments, MR. DUKE incidentally expressed regret that his learned friend on the other side should have thought fit to criticise the attitude of Mr. Keen.

His LORDSHIP (emphatically): I may say that there is not the slightest reflection on Mr. Keen, in my opinion.

After an adjournment his LORDSHIP held that the plaintiffs had made out their case, and granted the declaration asked for, with costs.

DISTRICT IRON AND STEEL CO., LTD., *v.* ARMORDUCT MANUFACTURING CO., LTD.

IN the King's Bench Division on Saturday, May 3rd, Mr. Justice Channell had before him an action brought by the District Iron and Steel Co, Ltd., of Smethwick, Birmingham, against the Armorduct Manufacturing Co., Ltd., whose works are at Witton, near Birmingham. The plaintiffs claimed the balance of account due in respect of a class of steel known as "Strip" supplied to the defendants, and the Armorduct Co., in addition to asserting their right to a cash discount of 2½ per cent., counterclaimed a rebate with reference to anterior transactions relating to close-joint iron and steel tubes. In the latter connection, reference was made to a circular sent out in March, 1907, informing buyers of such tubes that they would be paid a deferred rebate in respect of orders given to firms who had signed the circular. Such payment was to be conditional upon the purchasers confining their orders for the tubes to members of the Association that was formed, and to their being in no way interested in the manufacture of the tubes otherwise than as proprietors, partners, directors or shareholders in one or more of the firms and companies in question. It was stated, in evidence, that the defendants, who manufacture electrical appliances, bought the "Strip" steel for the purpose of manufacturing these tubes, and his Lordship, holding that this was in violation of one of the terms of the circular, gave judgment in favour of the plaintiffs on both claim and counterclaim, with costs.

OSRAM LAMP WORKS CO., LTD., *v.* THE ELECTRICAL MANUFACTURING CO.

IN the Chancery Division on Friday, May 2nd, before Mr. Justice Eve, this motion was again mentioned by Mr. Tomlin for the defendants. Counsel stated that he had agreed with Mr. Gray for the plaintiff company, that subject to his Lordships' sanction, the matter should stand over generally.

His LORDSHIP: Very well.

STRETFORD U.D.C. *v.* GORTON, LTD.

IN our issue of December 20th, 1912, under the heading "Feeder Pillars Again," we recorded a breakdown in connection with Stretford electric supply system. This occurrence had its sequel in the Manchester Assize Courts on May 1st, when the Stretford U.D.C. claimed damages in respect of injuries to property (a feeder pillar damaged to the extent of £122), by a runaway horse belonging to Messrs. John Gorton, Ltd., carriers, defendants in the action. For the plaintiffs it was contended that the driver of the vehicle should not have removed the bit from the horse's mouth, as thereby control of the animal was lost. For the defence it was shown that it was the proper thing to remove the bit for the horse to drink. Veterinary surgeons were called by both sides on this point, and ultimately the jury gave a verdict for the defendants.

BUSINESS NOTES.

Patent Notices.—Patent No. 9,145, granted in 1911 to Chas. Rudolph for "Improvements in unions or couplings with bayonet joints," has been revoked.

Book Notices.—"The National Form of Building Contract." By W. Valentine Ball and W. H. Hope. 1913. London: *The Local Government Journal.* Price 6s.

"Introductory Electricity and Magnetism." By Carl W. Hansel. 1913. London: W. Heinemann. Price 2s. 6d. net.

"*Proceedings* of the Physical Society of London." Vol. XXV, Part 3. April 15th, 1913. London: *Electrician* Printing and Publishing Co., Ltd. Price 4s. net.

"*Proceedings* of the American Society of Civil Engineers." Vol. XXXIX, No. 4. April, 1913. New York: The Society.

"The School of Mines Quarterly." Vol. XXXIV, No. 3. April, 1913. New York: Columbia University. Price 50 cents.

"The Physical Review." Vol. I, No. 4. April, 1913. Lancaster, Pa.: The American Physical Society.

"*Transactions* of the Illuminating Engineering Society." Vol. VIII, No. 3. March, 1913. New York: The Society. Price 75 cents.

"*Bulletin* Mensuel Société Belge d'Electriciens." Vol. XXX, March, 1913. Brussels: E. Bruylant. Price 1 fr. 75 cents.

"La Télégraphie sans fil, la Télémécanique et la Téléphonie sans fil à la portée de tout le monde." By E. Monier. 1913. Paris: H. Dunod & E. Pinat. Price 2 fr. 50 cents.

"Life Test and Economical Study of Incandescent Lamps." By T. Hirobe and R. Mitsuda. January, 1913. Tokio, Japan: Electro-Technical Laboratory.

"Atti della Associazione Elettrotecnica Italiana." Vol. XVII, Nos. 7 and 8. April 15th and 30th, 1913. Milan: Stucchi, Ceretti and C. Price L. 1.50 each.

"*Boletin* de la Sociedad de Fomento Fabril." Vol. XXX, No. 3. March 1st, 1913. Santiago, Chile. The Society.

The *Railway and Travel Monthly* for May is a special Argentine number. It contains a number of illustrated articles on the Central Argentine Railway, and on some of our great British railways, a number of the pictures being excellently produced in colour.

Bankruptcy Proceedings.—Chas. Musker, electrical, &c., engineer, 1, Northumberland Avenue, W.C.—An application for an order of discharge was made on May 2nd to Mr. Registrar Brougham at the London Bankruptcy Court. Mr. W. P. Bowyer, Official Receiver, reported that the applicant failed in September, 1912. Proofs of debt amounting to £6,364 had been tendered by creditors; the assets, valued by the bankrupt at £450, had realised £31, and a further £100 was likely to be received. In 1889 the bankrupt and a brother commenced business in partnership as C. & A. Musker, electrical and hydraulic engineers, at Bootle and sold the undertaking in 1895 to a limited company, of which they became managing directors. In 1901, in order that further capital might be raised, a new company, entitled C. & A. Musker (1901), Ltd., was formed, which took over the business, acquired further machinery and erected new buildings at Tuebrook, Liverpool, the applicant and his brother continuing to act as managing directors of the concern. In June, 1909, a Receiver for the debenture-holders was appointed, by whom the bankrupt was employed until September, 1911, when the works were closed. He attributed his insolvency to the failure of the last-named company, to the depreciation of his share interest therein, and to his household and personal expenses having exceeded his income. As offences the Official Receiver reported (1) insufficiency of assets to equal in value 10s. in the £ on the amount of the unsecured liabilities; and (2) contributing to the bankruptcy by unjustifiable extravagance in living. On those grounds the learned Registrar imposed a further suspension of two years. Order entered accordingly.

Cecil Wray, electrical and mechanical engineer, Bradford.—May 21st is the last day for the receipt of proofs for dividend. Trustee: Mr. W. Durrance, 12, Duke Street, Bradford.

C. S. Northcote, electrical engineer, Streatham.—May 23rd is the last day for the receipt of proofs for dividend. Trustee: E. W. J. Savill, 132, York Road, Westminster Bridge Road, S.E.

French Wire Lamps.—The Société Française d'Incandescence par le Gaz, of Paris, states that the company derived advantage from the working of its new electric lamp "O. R.," for the first time during 1912. This lamp is provided with a pressed filament, which is claimed to possess the advantage of a longer life than lamps having drawn-wire filaments, although the latter types are cheaper.

Electric Clocks.—With reference to a notice on electric clocks at the Ghent Exhibition, the Magneta Time Co., Ltd., of Chiswick, write:—"We wish to point out that your reference to this matter under "Business Notes," in your issue of the 25th ult., is liable to misconception. The chief postal buildings of London are equipped with the Magneta system, the dispatch of home and foreign mails depending thereon. We enclose a complete list of these installations, and in order that there may be no misapprehension, the following will convey a correct idea of the magnitude of this work. Taking a 12-in. dial as one unit, the aggregate of units for Government Magneta installations has reached 2,600 (two thousand six hundred), and, in view of the history of electric clocks, it may not be out of place to mention that although the first of these installations has now been at work some eight years, the running of this mass of Magneta apparatus has not cost the Post Office one penny for maintenance, or charges of any kind, up to this date. We felt these remarks were strongly called for, as the note might be read as the appropriation by others of the prestige which solely belongs to the Magneta system."

The list enclosed with the letter mentions the new G.P.O. (King Edward Building), London, and 15 other very important post offices and public works.

Holland.—The Dutch Customs authorities have lately given a decision to the effect that commutator brushes and brush-holders, armatures and pole cases for dynamos and electric motors, imported separately, "are to be classified as parts of factory machines" and admitted free of import duty.

Water Turbine Contracts.—Messrs. Boving & Co., Ltd., report having received the following orders for water turbines, pipe lines and pumps during the past month:—

Mount Lyell Mining and Railway Co.—4 Impulse wheels of 2,000 h.p. and three of 180, under a head of 1,000 ft., through the General Electric Co., of New York. Also, direct from the company, two pipe-lines of 750 and 550 mm. diameter and 2,900 ft. long.

Sagami Hydro-Electric Co., Japan.—3 Francis turbines of 3,750 h.p. and one of 180 h.p. under a head of 41 metres.

Porco Tin Mines.—1 Impulse turbine of 150 h.p. under 210 metres head, and a pipe-line 1,190 metres in length, 15 in., 12 in. and 10 in. diameter.

Compania Ingeniera Exportadora, Mexico City.—1 Francis turbine of 75 h.p.

Borough of Napier, N.Z.—1 Victoria turbo-pump 415 g.p.m. 325 ft. head, and one 830 g.p.m. and 170 ft. head, coupled to Lancashire Dynamo motors.

Also repeat orders for a Victoria mining pump from Messrs. Kilburn Brown to deliver 750 g.p.m. against 573 ft. head, and from the Great Western Colliery to deliver 417 g.p.m. against 745 ft. head.

A Modern Aladdin.—Mr. H. W. Leonard, of the General Electric Co., Ltd., Publicity Department, in the character of "the modern Aladdin with the wonderful (Osram) lamp" secured first prize at a fancy dress carnival at Birmingham, on the 26th ult.

Austria.—The Elektrotechnische Verein Brunn is the name of a new association, which has just been formed at Brunn, Bohemia.

Electric and Copper Works in Chile.—It is stated that the Siemens-Schuckert Works have secured an order of the value of £500,000 in connection with a scheme for the mining of copper ore in Chile. It appears that the New York metal firm of Guggenheim have acquired copper mines in the Chilean Cordilleras, and propose to work them. As a scarcity of water exists in this mountainous district, it is intended to employ electric power, which is to be transmitted from the coast. For this purpose a steam power station is projected in one of the coastal towns; the capacity is to be 60,000 h.p., and oil fuel is to be used for firing the boilers, in conjunction with turbo-generators. The power is to be conveyed to the mines at a pressure of 100,000 volts by means of overhead conductors, the distance being about 124 miles, and it is to be used in connection with the working and smelting of the ore and the production of electrolytic copper. The installation of the long-distance transmission line will be undertaken by the firm of Guggenheim, who are large producers of copper, whilst the transformers and distributing network, &c., at the mines will form the subject of future contracts. It is said that the Siemens-Schuckert Works have obtained the order for the generating station and plant in competition with the General Electric Co., the Westinghouse Co. and the A.E.G.

Catalogues and Lists.—Messrs. Schoen Bros., 29 and 30, Cock Lane, Snow Hill, London, E.C.—New four-page leaflet, giving illustrations, brief particulars and prices of a variety of apparatus for wireless telegraphy for experimental and demonstration purposes, which they hold in stock.

Messrs. T. Harding Churton & Co., Ltd., Atlas Works, Water Lane, Leeds.—New catalogue (No. 30) (20 pp.), containing detailed description with illustrations, of polyphase induction motors, starters and controllers for same, with tabulated data and prices. Representative characteristic curves appear of 15-h.p. three-phase and 50-h.p. two-phase motors, showing high efficiency maintained over a long range of load, and a high power factor. Single-phase induction motors are also described and priced. Messrs. Harding Churton report that their works have for some considerable time been exceedingly busy, working continuously day and night.

Mr. Harry Moss, 116, Horton Grange Road, Bradford.—Leaflet showing a patent electric window heater.

Messrs. Simplex Conduits, Ltd., 116, Charing Cross Road, London, W.C.—Leaflet illustrating and pricing their inspection electric hand lamps for motor-cars.

Messrs. W. T. Henley's Telegraph Works, Co., Ltd., Blomfield Street, London Wall, London, E.C.—A new telephone cable catalogue of nearly 140 pages has been issued. It is divided into three sections as follows:—(1) Underground telephone and telegraph cable; (2) aerial telephone and telegraph cable; (3) miscellaneous cables, accessories, and subaqueous cables. In view of the company's long and varied experience of the manufacture of such cables, the publication, with its specifications, tests, illustrations and general information, naturally possesses considerable interest for telephone engineers. Full specification and details are given of all the various types of cable used, which include—in addition to the usual lead-sheathed single, twin, multiple twin and quad. type, dry core telephone cable and screened telegraph cables—various types of rubber insulated cables and wires used for both indoor and outdoor work, also flameproof switchboard cables and wires, together with tests and notes describing the purposes for which each type of cable is designed. Information is given with regard to the important question of jointing, and prices of all necessary jointing materials are included. Particulars

of various types of subaqueous cables have been included, and the question of loading cables is dealt with; we understand that the tests shown in the catalogue are put forward as being consistent with an economical and practical cable. Lower capacity tests can be given, but such would necessitate an increase in diameter, and a consequent increase in cost. For convenient reference, class numbers and code-words are given for all types. Owing to the firm's large foreign business in telephone cables, they have found it necessary to give dimensions in both the English and metric systems, and for the convenience of foreign clients have included a table of money conversions.

Messrs. Daniel Adamson & Co., Dukinfield.—Illustrated descriptive circulars of their patent Adamson-Davies tubular extension for Lancashire or Cornish boilers. Particulars of tests are tabulated.

British Economical Lamp Co., Ltd., 9, Old Bailey, London, E.C.—Two illustrated and priced leaflets give particulars of the "Lotolite" crystal glass reflector fittings—concentrating, expansive, intensive and extensive types; also of Belco arc fittings for high C.P. lamps, for inside and outside lighting.

Messrs. O. Ellefsen & Co., 26A, Silver Street, Bedford.—Pamphlet (12 pages) describing and illustrating Ellefsen's new patent low-water alarm and feed regulator for steam boilers.

The Sterling Telephone and Electric Co., Ltd., 200, Upper Thames Street, London, E.C.—Publication No. 203 gives prices of, and illustrated information regarding, "Primax" automatic interphones.

Messrs. David Rowell & Co., 33, Old Queen Street, Westminster, London, S.W.—12-page pamphlet giving an illustrated description of the Barrol system of ventilation for schools and churches.

Dissolutions and Liquidations.—Marsh, Son & Co., Ltd., 167 and 169, Wardour Street, Oxford Street, London, W.—A circular has been issued by the managing director to the effect that for some time past the business has been carried on at a loss, and the company is being wound up voluntarily. Mr. Marsh adds that he is the sole debenture-holder and hold debentures for £9,200, which are a first charge over all the assets of the company. The assets in question, when realised, will not be sufficient to pay off all these debentures in full. He is very desirous that all the creditors of the company should be paid, and he does not therefore propose to take advantage of his position as debenture-holder, but intends to apply the moneys received by him in respect of his debentures in payment of the debts of the company. The liquidator, Mr. R. W. Brown, who is well acquainted with the business, will realise the assets to the best advantage, and Mr. Marsh says that he hopes that the amount realised will be sufficient to enable him to pay all the creditors in full. "If, for any reason, another liquidator should be appointed by the creditors, I must hold myself at liberty to reconsider the course which at present I propose to adopt." A meeting of creditors is to be held on May 15th at the Holborn Restaurant.

Carney & Pearn, Ltd.—This company is winding up voluntarily with Mr. B. H. Brook Eldridge, 52, Brown Street, Manchester, as liquidator.

Walburn & Mills, electricians and motor engineers, 92, Wharf Street, Sowerby Bridge.—Messrs. E. Mills and J. B. Walburn have dissolved partnership. Mr. Walburn will attend to debts.

Ingham, Barrie & Co., consulting and contracting engineers, Highbury Chambers, Newport.—Messrs. O. Ingham and J. S. Barrie have dissolved partnership. Mr. Barrie will attend to debts, &c.

Lane & Co., builders and electrical engineers, 1, Gage Street, Bloomsbury, W.C.—Messrs. E. Lane and A. Purrier have dissolved partnership. Mr. Lane will attend to debts.

Trade Announcements.—Messrs. Dorman & Smith, switchgear and fittings manufacturers, of Ordsal Electrical Works, Manchester, have made arrangements to be represented in Scotland by Mr. David Alexander, of 43, Mains Street, Waterloo Street, Glasgow, at which address samples of their fittings and switchgear, more especially such apparatus as is used in ships and collieries, may be inspected. Telephones: Central 4394, Argyle 587; Telegrams: "Ohmic, Glasgow."

Messrs. Berry, Skinner & Co. announce that their agency, which has until recently been in the hands of Mr. David Alexander, of 43, Mains Street, Waterloo Street, Glasgow, has now been transferred to Mr. J. Hally Craig, of 45, Hope Street, Glasgow, to whom all local inquiries should be directed.

The Eastern Electric and Trading Co., of Karachi, intend to stock large quantities of electrical accessories, as electric supply (D.C. 220 volts) will soon be available there. Fans, metal-filament lamps of all candle-powers (no carbon lamps will be used, and drawn-wire lamps are preferred), fittings, wires and cables, and accessories of all kinds will be required, and manufacturers are invited to send samples.

Messrs. Electrical Installations, Ltd., have taken additional offices at 28, Martin's Lane, adjoining their existing premises, 27, Martin's Lane, Cannon Street, E.C., owing to growth of business.

The British Thomson-Houston Co., Ltd., announce that the address of their Middlesbrough office was altered from Wednesday, 7th inst., from Maritime Buildings to Prudential Chambers, Albert Road, Middlesbrough. The telephone number remains unaltered—(No. 814).

Messrs. Friend, Wilton & Co. have removed from 17, Quay Street, Cardiff, to 8, Westgate Street, Cardiff.

Private Arrangements.—George Ashford (trading as Whitcombe & Co.), electrical engineer, Newhall Hill, Birmingham.—The creditors interested herein were called together last week when a statement of affairs was presented showing liabilities of £547, all of which was due to unsecured creditors. There was a fully-secured creditor for £99, who held securities valued at £100. The assets were returned at £261. It was stated that the debtor started trading at his present address in September, 1911, with a capital of about £80, his own savings. Shortly afterwards he was joined by another man who brought no capital into the concern. Last August the partner retired, and another man then put into the business £185 in cash and a debenture for £100 in the New York Telephone Co. The debenture was said to be worth its full face value, and was held by the bank, who were returned as fully-secured creditors. The present position was attributed to losses on contracts, and it was stated that a considerable loss had been made in connection with a picture palace. In that connection a debt of £50 was due to the debtor. The debtor was also said to be interested in a patent unpuncturable tire, which it was believed would be a success. He was in negotiation with one of the large tire companies for the sale of the patent, providing a 500-mile trial run was first made on it. A deed of assignment had already been executed, and after a short discussion it was decided to confirm the deed, and to adjourn the meeting.

LIGHTING and POWER NOTES.

Accrington.—The Electricity Sub-Committee has been deputed to deal with an application from Alliance Mill, Baxenden, for a supply of energy for power purposes, and has also been asked to deal with the question of opening an electricity showroom in some other situation, in lieu of the present showroom.

Barrow-in-Furness.—At the T.C. meeting on Monday, recommendations of the electrical engineer were approved providing for the whole of the arc lamps in Bridge Road being replaced by clusters of four 100-watt metal-filament lamps, and those on Walney Bridge being replaced by 400-watt metal-filament lamps, the carcasses of the arc lamps on the bridge being adapted to take these lamps. It was reported in regard to the electricity works extensions that the contractors had delivered and practically completed the erection of the water-tube boiler and chain-grate mechanical stoker ordered in December last. It was agreed to approve the installation of cleaning apparatus by the British Vulcan Soot Cleaner Co., Ltd., Edinburgh, at a cost of about £80. During this week a series of demonstrations of electric cooking by means of "Tricity" cookers are being given in the Technical Schools, under the auspices of the Barrow Corporation.

Basingstoke.—The T.C. has been informed that its application for a prov. order for electric supply has been granted by the B. of T.

Bedworth.—The question of having the parish publicly lighted by electricity has been discussed by the Parish Council, which has asked the Leicestershire and Warwickshire Electric Power Co. if it will tender for the lighting in competition with the gas company.

Birmingham.—Elsewhere in this issue we give some details of the proposed new power station at Nechells, and electrical extensions in the city. The Finance Committee has reported on the proposals, and offers no objections on financial grounds. It, however, draws attention to the fact that sums of £5,380 for sub-stations, and £46,546 for mains had been expended prior to the approval of the Council being given to the scheme, and regards this as undesirable practice. The Committee also appears to view with concern the effect of the last revision of charges, and points out that the erection of these new works will involve the necessity for regular, systematic and adequate contributions being made in every succeeding year to provide for the contingency of obsolescence. It may be mentioned that the electricity department has a reserve fund of £80,458, and a renewals fund of some £32,000.

Blackburn.—The Electricity Committee has adopted the report of the electrical engineer on the scheme for the erection of new electricity works; the Gas Committee offers land at Greenbank as a site for the new station, subject to suitable terms being arranged.

Blackpool.—The Corporation electricity department for the past year had a net surplus of £13,179, compared with £6,240 in the previous year. The income was £40,333, against £35,454 in 1912, and £3,633 more than the estimate. The working expenses amounted to £20,928, against £16,347. The reserve fund now stands at £9,508. The aggregate of the works output for the past 12 months was 4,109,983 units—an increase of 544,229. Of the increase, 333,138 was due to private lighting, showing that the public are adopting electric lighting more generally. There were 239 new consumers during the year.

Bognor.—The U.D.C. has asked the Gas Co. to submit a scheme of electric lighting for the sea front in substitution for the present gas lighting.

Bridlington.—It is estimated that the net profits on the electricity undertaking for the year ended March 31st, 1913, will amount to £1,376.

The Electricity Committee has decided to apply to the L.G.B. for sanction to borrow £3,000, £1,500 being in respect of mains and £1,500 in respect of services.

Bradford.—The Corporation Electricity Committee has recommended the extension of mains from the Dudley Hill transforming chamber along Tong Street to Montserrat Mills, at a cost of £2,191, and a similar extension from Victoria Street to Lumb Lane Mills, at a cost of £520.

The engineer has been directed to proceed with the work of changing the system of supply in the Manchester Road district, south of Bowling Old Lane, from direct to alternating current.

Brighton.—With a view to increasing the capacity and improving the efficiency of the Southwick generating plant, the T.C. has had under consideration a proposal by Mr. Christie, the borough electrical engineer, to replace one of the original turbine plants by a Richardsons-Westgarth turbine driving a 3,000-KW. Siemens alternator, speed 3,000 R.P.M. With condensing plant the cost is estimated at some £7,600. Alterations to pipework, foundations, switchgear, &c., will cost £900. The displaced plant will, it is proposed, be sold, and the cost of the above work be met out of revenue and reserve.

Chester.—The Corporation has adopted the proposed battery scheme, to cost £11,550, reported on by the city engineer Mr. S. E. Britton, and recently described in these notes.

Chester-le-Street.—The L.G.B. has sanctioned an expenditure of £410 by the Guardians in carrying out the scheme for lighting the workhouse, &c., by electricity.

Clones.—The Urban Council has discussed the terms under which Mr. Chas. Ferguson is to be permitted to carry out an electric lighting scheme in the town. The Council will have the option of purchasing the works after 10 years.

Continental Notes.—ITALY.—La Società per Imprese Elettriche, of Rome, has secured a contract from the Officine Elettro-Chimiche Dottori Rossi, of Legnano, for the establishment of a plant near Rome, for the electric production of nitric acid from the atmosphere. The plant to be at first put down will be of 5,000 KW., provision for doubling it at a later date being made

Coventry.—The Electric Light Committee has passed the accounts for the year ending March 31st last, showing an available balance of £16,294. It was decided to recommend the City Council to apply £4,500 to the relief of rates and £11,000 in payment of new machinery, &c. (in lieu of raising a loan), and to carry forward the balance of £194. The Committee will also recommend an increase of the salary of Mr. G. Tough, electrical engineer and manager, from £550 to £650 per annum; also that the flat-rate charge of 4½d. per unit for current for lighting purposes be reduced to 3½d.

Delabole (Cornwall).—At the annual meeting of the Parish of St. Teath it was decided to light Delabole by electricity. At a public meeting of the electors, Mr. R. Pearce, who was in the chair, reviewed the position, after which it was decided to obtain the necessary powers.

Derby.—The T.C. has applied to the L.G.B. for a loan of £11,950; for mains £7,500, services £700, motors £3,000, and transformers and switchgear £750.

On May 2nd, a L.G.B. inquiry was held into the application of the T.C. for a loan of £13,500, needed principally for additional generating plant. There was no opposition.

Dundalk.—Last week a L.G.B. inquiry was held into an application by the Council for a loan of £5,000 for extensions of the electric lighting scheme in the town. From the evidence it appeared that the Council had already obtained a loan for electric lighting of £20,000. Owing to the increasing demand for electricity £5,000 more was needed. The amount received for energy sold during the year was £1,729, showing a net profit of £600. The inspector stated that he was glad to know that this much-debated scheme had been so successful.

Eccles.—The Public Lighting and Electricity Supply Committee has made a recommendation that Devonshire Road be lighted by electricity.

Edinburgh.—Treasurer MacLeod, in submitting the draft provisional estimates for the year from May 15th, 1913, to May 15th, 1914, said, with regard to the estimates by the Electric Lighting Committee, the estimated surplus was only £220. The policy of the Committee was to frame its estimates so as to come out practically square at the end of the year. The estimated revenue was £142,660, which was counterbalanced by expenditure of £80,265 and interest and sinking fund contributions of £62,175. Under this head was noted the great increase in the coal bill, which was estimated at £30,840, as against the actual in 1911-12 of £20,041. The revenue for the same year was £131,678, so that while the revenue had only increased 8 per cent. the coal bill had gone up 50 per cent. in the same period, without any increased charge to the consumer. The capital expenditure for the coming year includes an item of £11,360 for extension of electric light works. Dealing with the rates and the likelihood of an increase, Mr. MacLeod said he was confidently looking forward to a surplus from the electric light account, which might be applied to reduce the amount required from the rates. Councillor McMichael, in the discussion which followed, said, in his opinion, the Council had a right to expect very substantial relief from the electric light undertaking. Mr. Stevenson, replying, considered it complimentary to the success of the cooling towers when they found that, although their coal bill alone had increased £6,000, the cost to the consumer remained unaltered.

Ellesmere Port and Whitby.—The B. of T. has granted a prov. order for electric light to the U.D.C.

Falkirk.—An interesting function took place last week when an addition to the generating station was formally inaugurated. Space has been provided for additional turbine plant of 2,700 H.P. Up till 1911 the supply was entirely on the low-pressure direct-current system. In 1910-11, in order to meet the power requirements of the large industrial concerns of Falkirk, the plant was extended, and the extra H.T. alternating current three-phase system adopted for the supply of the burgh. The 1910-11 extension consisted of a steam turbo-generator of 670 H.P., a new boiler, and about 4½ miles of mains. Owing to the rapidity with which the demand for power purposes grew, a further 670-H.P. turbine was installed for the winter of 1912-13. Transformer sub-stations are in operation at Falkirk Ironworks, Etna Foundry, Crown Brass Works, Sunnyside Foundry, Camelon Main Street, and Union Road; and Cros's Chemical Works, Camelon. During the last two years nearly 1,000 H.P. of electric motors has been connected to the Corporation system. The Falkirk Iron Co. has nearly 500 H.P. of motors being supplied from the Corporation mains, and the demand for electric power from this consumer alone is already more than equal to the demand for electric lighting purposes from the whole of Falkirk.

Gargrave (Yorks).—A proposal is on foot for lighting this village, in the Craven district of Yorkshire, by electricity. The supply station, it is proposed, will be at the High Mill, owned by Mr. Joseph Mason. Messrs. Crompton & Co., Ltd, are to carry out the work of installation if the proposed scheme is successfully launched.

Harwich.—Last week Dr. C. H. Liebbrand addressed a meeting of the ratepayers on the subject of electricity supply for Harwich and district, explaining his scheme for centralising electric supply at the seaside resorts of Lowestoft, Clacton, Walton and Felixtowe.

Henley.—The Reading Electric Supply Co. having applied to the R.D.C., for consent to supply current to premises at Sonning and Shiplake, the Council has decided that "under present conditions" permission cannot be given in respect of Shiplake, and with regard to Sonning a decision has been deferred, the Council intimating that if the company desired to supply electricity in districts outside its area it should proceed by prov. order.

Hereford.—The L.G.B. has sanctioned the conversion of the pumping plant at the waterworks from steam to electricity.

Hull.—The T.C., on May 1st, decided, by 21 votes to 18, not to purchase the prov. order for electric supply obtained by Hessle U.D.C., for £462.

Keighley.—A L.G.B. inquiry was held last week into the application of the Corporation for powers to borrow £7,000 for purposes of the electricity undertaking. The electrical engineer (Mr. Harry Webber) said the money was required for the purchase of a new turbo-alternator; the contract had been placed provisionally. The estimated profit on the year's working was about £1,000, there having been a large increase in sales, chiefly in respect of power. The outstanding borough loans, it was stated, now amount to £100,640, and the department had received rate aid to the extent of £12,130. The new turbine would cost £5,827, and other requirements would bring the amount to £7,000. The inspector suggested that the application should be increased by £200, as if an outstanding debt on economiser tubes were deducted, the total amount at present asked for, would be insufficient.

Kendal.—The T.C. has applied to the B. of T. for permission to erect overhead wires in various parts of the district for the supply of current at a pressure of 220 volts.

Leyburn.—The local gas company is putting down electric plant at its works to supply in the locality, and has applied to the Council for permission to use overhead wires.

Liverpool.—Sanction has been received from the L.G.B. to the borrowing of £40,000 for the provision of mains.

London.—HAMPSTEAD.—A very careful series of tests carried out by Mr. H. H. Couzens, with the object of improving the electric street lighting in the Hampstead district, has resulted in the Council deciding to adopt similar fittings to those designed and erected by Mr. Haydn Harrison in the borough of St. Marylebone and elsewhere. In certain important streets new posts are to be erected at a distance of 30 yards apart, the height of the light source being increased so as to produce a satisfactory minimum horizontal illumination, as described in the draft Standard Street Lighting Specification, which has lately been the subject of a paper read by Mr. A. P. Trotter. Mr. Harrison has been instructed to proceed with the work immediately, so that the illumination of the Hampstead streets will be much improved before the autumn.

HACKNEY.—The L.C.C. has sanctioned the borrowing of £58,100 in connection with the extension of the undertaking. Sites in Lauriston Road and Dalston Lane are to be purchased for the erection of sub-stations.

MARYLEBONE.—The L.C.C. has sanctioned the borrowing of £42,500 for the electricity undertaking. This is for the provision of two 3,000-KW. turbo-alternators with condensing plant; four 1,000-KW. converters; switchgear and feeder cables. The plant capacity at the B.C.'s station next winter will be 17,400 KW., and the maximum load is expected to reach 10,300 KW., giving a

reserve of 7,100 KW., apart from battery plant, which represents some 1,500 KW. The Finance Committee (L.C.C.) has been advised that this margin is not excessive. The loan periods sanctioned are 15 years for the turbine plant and switchgear, and 25 years for mains.

BERMONDSEY.—A loan of £2,035 is to be taken up from the L.C.C. in connection with the undertaking.

Lytham.—The draft of the Lytham Electric Lighting Order has been received by the Council, and contains a special clause protecting the Blackpool, St. Anne's and Lytham Tramways Co. against having to take a supply of current from Lytham during the existence of the company's agreement with St. Anne's Council. This agreement lapses in June, 1917. The other clauses are of usual nature.

Manchester.—The scheme for improving the lighting of the central streets of the city was to come before the City Council on Wednesday. The capital cost spread over three years will be £15,000 for electricity and £18,000 for gas.

New Zealand.—The contract for the erection of the power house at Lake Coleridge has been let to Messrs. Taylor Bros. and Mooreland, of Christchurch, the price being £15,636.

Northwood and Ruislip.—The B. of T. has granted a prov. order for electric lighting to the Northwood Electric Light and Power Co., Ltd., for supplying current to certain parishes in the area of the Watford and Rickmansworth R.D.Cs. The B. of T. dispensed with the consent of the Watford R.D.C. to the company's application.

Nottingham.—There is a gross profit of £39,319 on the working of the electricity department during the year ended March 31st last. After allowing for repayment of loans, interest on consolidated stock, sinking fund, &c., there remains a net profit of £10,890, of which £8,000 is to be appropriated in aid of the general district rate, and £2,890 transferred to the reserve fund. The amount realised during the year from the sale of current amounted to £93,579; from rent of meters, £1,931; and from public lighting, £732. The number of units generated totalled 13,599,812, and the quantity sold was 12,602,306, as against 13,563,732 and 12,577,326 in 1911-12. The engineer, in his report on the year's working, states that extensions of mains amounting to 1·32 miles have been made during the year, and the total length of distributing mains at March 31st was 63·05 miles. There has been an increase of 234 in the number of applications for a supply of electricity, the consumers at the end of the year, 4,415, showing largest increase since 1906. The adaptability and convenience of electric motors is shown by another large increase in their number. The 191 additional motors aggregating 480 H.P., which have been connected to the mains, bring the totals to 1,540 motors and 5,690 H.P. During the 12 months 3,909,847 units were sold for lighting, 2,931,363 for power, and 5,761,096 for traction. The units used for lighting show an increase for the first time since 1908, when metallic-filament lamps began to be used; 23·65 per cent. of the units used for private lighting were at the flat rate of 3½d. per unit, which has been in operation nine months; 60·51 per cent. of the units for private lighting charged on the maximum demand system were at the reduced rate of 1½d. per unit. There has been an increase of 1s. 9d. per ton in the cost of coal, and the total additional cost for the eight months the increase has been in operation, is £3,099. It is estimated that the consumers who have adopted the flat rate have benefited to the extent of £2,395.

Nuneaton.—The Trades Council has passed and forwarded to the T.C. a resolution urging the Corporation "to make electricity a more utilitarian product for lighting, cooking, heating, &c.," in order that it may replace gas in the homes of working men.

Port Glasgow.—The B. of T. has granted the Electric Lighting Order promoted by Port Glasgow T.C., in favour of Greenock Corporation entering the burgh to supply the shipbuilders and others with electricity.

Rishton.—The D.C. has agreed to the Accrington Electricity Committee supplying electricity at Rishton Paper Mills, subject to the supply being discontinued at a time to be agreed upon. The Accrington Electricity Committee has accepted these conditions, subject to the insertion of a clause fixing the minimum period at seven years.

Salford.—On May 1st there was held a L.G.B. inquiry into the application of the Corporation for sanction to borrow £35,900 for the purposes of the electricity undertaking. The town clerk said that £25,000 out of the £35,000 was required to cover the anticipated expenditure during the next few years on mains and service cables. Mr. H. Hawkins (electrical engineer) said an arrangement had been made to take a bulk supply from the Lancs. Electric Power Co., and in connection with this the laying of mains would cost not less than £8,000 during the first 12 months. In addition to that, the ordinary anticipated expenditure on continuous-current mains would be at the rate of about £4,000 per annum. During the second year there would have to be a further outlay in connection with the provision of extra-H.T. three-phase mains, which would cost something like £6,000. There would also be an expenditure of about £4,000 for the ordinary continuous-current mains during the second year. The total expenditure for three years would be about £25,000. In answer to the Inspector, Mr. Hawkins said the generating station capacity was 9,250 KW., and the maximum demand was just under 9,000 KW. There was no opposition to the application.

Sevenoaks.—The Sevenoaks Electricity Co. has, owing to a difficulty arising, asked the U.D.C. to consent to the withdrawal of the purchase clause in the agreement with respect to the E.L. scheme. The Council has decided not to dispense with a purchase clause, and has submitted a draft clause to the B. of T., with a view to it being inserted in the proposed prov. order.

Shipley.—A L.G.B. inquiry was held on the 30th ult. into the application of the Council for powers to borrow £5,700 for electrical plant. It was explained that the requirements were for cable-laying and providing equipment for supply of H.T. current. The Council was unable to meet demands by means of the existing plant. Complaints had been made by consumers that satisfaction was not being given, and owing to agreements made by the Council with textile and other manufacturers, and for other reasons, the Council felt obliged to proceed with the works without waiting for the sanction of the L.G.B., and the work was now practically completed. No opposition was offered to the application.

At the last meeting of the Electricity Committee it was reported that there were at the present time 701 lighting consumers on the Council's mains. An application had been received asking terms for the supply of electricity temporarily for power purposes at Lower Holme Mills.

South Africa.—A CAPE TOWN HYDRO-ELECTRIC PROPOSAL.—For some time the question of augmenting the water supply in the Cape Peninsula has been under consideration, there being apparently a barely sufficient supply of that necessary commodity available at the present time. In this connection a correspondent sends us some particulars of a tender which has been submitted to the Mayors and Councillors of the Peninsula municipalities by Messrs. A. and C. Struben for the supply not only of water but also of electricity, the water being obtained from the Steenbras River, 35 miles from Cape Town. The total cost of the scheme is £520,000, of which water supply accounts for £270,000, and electrical supply for £250,000. The tender provides for the supply of 5,000,000 gallons of water per day and 12,000,000 KW.-hours of electricity per annum to Cape Town, and by the diversion of adjoining waters these quantities could be doubled. Thus the scheme proposes to dam the Steenbras River, and so form an artificial lake several miles in length at an elevation of 1,115 ft. above sea level. The dam would contain 3,000 million gallons of water, taking a depth of 75 ft. From the reservoir a 2,540-ft. tunnel passes under a hill to two 33-in. diameter steel pressure mains leading to a preliminary hydro-electric generating plant, situated 280 ft. above sea level, and designed to use 5,000,000 of the total of 15,000,000 million gallons of water delivered daily, while the remainder would be used in a second power station, 50 ft. above sea level. The tail water from the first scheme would be purified and delivered to the Council's waterworks, while the lower station would discharge into the sea, unless the water were required for agricultural purposes. The upper station is proposed to contain 1,400 KW. and the lower one 6,400 KW. of plant; both stations would supply through the lower one, where the current would be stepped up to 40,000 volts pressure for transmission over duplicate three-phase overhead mains a distance of 35 miles to a receiving station in Cape Town. The estimates of working cost are of considerable interest, as the total annual charges, including interest at 4 per cent., and depreciation at half that rate, amount to £47,310, whereas the revenue derived from the sale of water at 6d. per 1,000 gallons, and of electricity (12,000,000 units) at ½d. per unit, totals £52,375. These prices are for water and electricity delivered. Last year the Cape Town Corporation generated 4,000,000 units in its own plant, requiring over 9,000 tons of coal, or an average coal cost of 6d per unit, so that the scheme which, of course, looks towards the industrial developments of the future and the electrification of local railways, appears to be of considerable interest.

Stalybridge.—The Council is installing four 3,000-KW. Curtis-Rateau turbo-alternators at its power station, which will then have plant installed of 19,000-KW. capacity.

Stroud.—Some years ago a private company proposed an electric lighting scheme for Stroud and district, and the U.D.C. obtained a prov. order for its own protection. The order was renewed year after year, and eventually allowed to lapse, this transaction costing the ratepayers £500, and proving a bar to progress. Now another private company is in the field, with a scheme for electric supply for the town of Stroud and district, and both the U.D.C. and the R.D.C. have consented to waive any objection they might have to the proposal on certain conditions, which have been agreed to, but the B. of T. has objected to the conditions which the promoters of the scheme have entered into with the R.D.C., and states that the order must either be given up so far as the latter is concerned or else the Council must withdraw its conditions. This means that the R.D.C. will be struck out from the Electric Light Order, which will be confined to the area of the Urban Council. The latter authority has obtained the insertion of a clause in the prov. order providing for option of purchase in 21 years, it being understood that with the granting of powers the promoters would forthwith proceed to carry the same into effect. It is not anticipated that the R.D.C. will agree to withdraw its conditions, and the clerk is in correspondence with the B. of T. on the subject.

Tyneside.—Efforts have recently been made to exploit the pit heaps on the sites of disused collieries near Coxhoe, as much good coal is known to exist in them. The rubbish from South Kelloe heap is being loaded into trucks and hauled to the Carville power station, where some 400 or 500 tons are being sent each week. The waste is also being used for firing at local brickworks, and its use will eventually clear large areas of land at present disused.

U.S.A.—According to the *Wall Street Journal*, Los Angeles is the most highly-developed electrical city in the world. It is said that 98 per cent. of all habitable dwellings are wired for electric supply, and that there is a meter for every 4¾ inhabitants.

Watford.—At the last meeting of the B. of G. it was stated that the installation of electric light at the workhouse had resulted in £74 being saved in one quarter, compared with the previous cost of gas.

West Bromwich.—According to reports issued on the 2nd inst., the sales of electric energy during the year ended March 31st amounted to £17,618, which is an increase of £1,121 upon last year. For private lighting there is an increase of £136, and for motive power an increase of £1,100, but for traction there is a decrease of £115.

West Ham.—The Corporation Electricity Supply Department has arranged for electric cooking demonstrations and lectures to be given by Mr. F. S. Grogan at the Town Hall, Stratford, from May 19th to 22nd, at 3.30 p.m. and 7 p.m. each day.

Worthing.—Acting on the report from the electrical engineer, Mr. G. Porter, the Electricity Committee of the T.C. has decided that provision should be made as soon as possible for additional plant and buildings to meet the increasing demand upon the machinery, and authority has been given for the preparation of the necessary plans and estimates, with a view to the Committee reporting to the Council at an early date.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—The "Pay-as-you-enter" system of cars has been adopted by the Corporation on the Woodside section. The T.C. contracted for 10 cars, which have been constructed by a local firm at a cost of between £800 and £900 each. At the inauguration ceremony, Mr. R. Stuart Pilcher, the manager, was heartily congratulated on his enterprise in introducing the cars. The innovation, which appeared to work quite smoothly, created great interest.

Accrington.—The year's working of the Corporation tramways undertaking shows the total receipts to have been £27,822, an increase of £1,601. The total working expenses were £15,455, or £340 less than last year. The balance to net revenue account was £12,367, as compared with £10,426 in the previous year, an increase of £1,941. The gross profit was £4,553, and the net profits £1,194.

Belfast.—At the monthly meeting of the Corporation last week, the minutes of the Tramway and Electricity Committee contained Mr. Mance's annual statement on the tramways. Alderman Finnigan said that it was thought that there would have been a larger revenue, but, on the whole, it was a satisfactory one. The forecast of profits was £260,000, but expenses had gone up, and instead of amounting to £135,000, they were £143,000. The nominal net profit was £16,000. There was an increase of £2,500 in sundry wages, and the late wet summer lost them £5,000. Recently a lot of the old cars had been converted into up-to-date cars.

Bingley.—Last week, a L.G.B. inquiry was held into an application by the Council, for powers to borrow £19,930 for street and highway improvements in connection with the scheme for the extension of tramways from the present Nab Wood terminus of the Bradford system, for which the Bingley Council has obtained powers. There was no opposition.

Blackpool.—The tram-fares question has been settled for another year: there was an agitation for 1d. fares on the Promenade, and Mr. Chas. Furness, the manager, pointed out that during 21 weeks last year, the tramway systems of Blackpool and Bournemouth each carried about 7½ million passengers; at Bournemouth, where there were 1d. stages, the receipts were £45,840, while at Blackpool, principally through the 2d. minimum on the Promenade, the receipts were £54,794. Mr. Furness pointed out that the difference of £8,954 in favour of Blackpool made all the difference between profit and loss, and enabled them to face the loss of £10,000 incurred in maintaining the tramway service during the winter, for whilst the average weekly winter receipts in Bournemouth were £1,600, they were only £600 at Blackpool. He estimated that the adoption of 1d. stages during the season would mean a loss of from £7,000 to £10,000. It was stated that as from 80 per cent. to 90 per cent of the tramway receipts were contributed by visitors during the summer, it would be folly to make any change which would result in adding to the ratepayers' burdens. Therefore no change was made.

Bolton.—The revenue account and balance-sheet of the tramways undertaking for the year ended March 31st, 1913, has just been presented to the Tramways Committee by the borough treasurer. The Committee approved the accounts, and resolved to transfer £13,500 towards the relief of the rates, as compared with £10,500 last year. The reserve fund now stands at £55,901.

Bury.—Mr. W. Clough, the general manager of the tramway undertaking, in his annual report, states that the gross traffic receipts amounted to £67,525, as compared with £66,074 for the previous year, an increase of £1,451. The figures for the year 1911-12 were, at the time, regarded as the maximum because several exceptional factors had contributed to the result. To have exceeded the result of that record year was extremely satisfactory. The gross receipts were allocated as follows:—Bury sections, £44,167; Radcliffe sections, £13,892; Heywood sections, £7,226; and Salford sections, £2,239. There was a net surplus on the Bury sections of £9,572, to which had to be added the net surplus of £1,252 from the Radcliffe tramways, making a total net surplus of £10,824. Of this amount, £6,252 had been contributed to the borough rates, £3,572 carried to reserve and depreciation fund, and £1,000 used to commence an insurance fund against third-party claims.

Continental Notes.—RUSSIA.—La Societé des Tramways de Kischinew has taken over the municipal tramway system in the town of Kischinew, and, under a 45 years' concession, is converting the same to electric traction, as well as constructing several new lines. It is expected that the work of conversion will be completed by October next. The necessary electrical energy will be supplied from the municipal electric power station.

Dewsbury.—The Batley Corporation having intimated its inability to undertake the construction of a line of tramway in Dewsbury Gate Road, the Dewsbury Electricity and Tramways Committee has decided to notify the intention of the Corporation with respect to a physical junction between the Shaw Cross and Westborough tramways to the Yorkshire (Woollen District) Tramways Co. and the National Electric Construction Co., and inquire if, under the circumstances, they are prepared to submit to the Committee amended proposals for dealing with the matter.

Doncaster.—The R.D.C. has decided to support the Mexborough and Swinton Railless Tramways Bill, which has met with strenuous opposition on the part of many of the smaller townships of South Yorkshire. The support has been given on an undertaking that clauses will be inserted for the protection of the Doncaster Council.

Jarrow-on-Tyne.—A letter from the Jarrow and District Electric Traction Co., stating that the directors are being pressed to provide improved travelling facilities between Jarrow and South Shields, has been received and considered by the Corporation Tramways Committee of South Shields. The company expresses the opinion that the time is opportune for the renewal of through running over the Shields tramways, and asks whether the Corporation is prepared to discuss the matter. The Committee has decided that the Corporation is not prepared, in view of its previous experience, to discuss the question of running powers.

Keighley.—At a meeting of the T.C. last week, the chairman of the Tramways Committee moved that, instead of continuing to insure the motor-omnibuses against damage and the Corporation against third-party risks, £200 per annum should be set aside and paid into the existing tramway insurance fund. Outside insurance, he said, had cost £365 in two years, and only £62 had been received on account of claims. The local tramways insurance fund had been formed through the laying aside of 1s. 6d. per 100 miles run, and the fund now stood at £965. The motion was adopted.

The Corporation has received official sanction to the running of a service of railless cars from Ingrow for the next three months.

Liverpool-Ormskirk Electric Railway.—May 1st marked the inauguration of a full electric train service between Liverpool and Ormskirk, made possible by the completion of the electrification extension from Town Green to Ormskirk. The provision of the new storage battery station at the latter town enables practically a half-hourly service to be maintained, and only through steam-trains to and from the north will run on this portion of the line in future. It is expected that the quickened service will prove beneficial to the Ormskirk district as a residential centre.

London.—L.C.C.—The Highways Committee, in view of the alterations to be made at the Greenwich generating station and the shortage of plant, has made arrangements with the London Electric Supply Corporation to purchase up to 2,000 KW. at £3 per KW.-year, and 3d. per unit, for a period of not less than nine months. This represents a charge of £13,750 as compared with £11,870 if obtained from the Council's own plant.

Manchester.—A report has been prepared by a Special Sub-Committee of the Corporation Tramways Committee upon the question of the congestion of tramway traffic. Attention has been concentrated solely upon what may be described as the passenger transportation problem—how best to meet the demands of the travelling public between the central parts of the city and the various suburban districts. The report states that the problem is of so important a character, affecting so vitally not only the future of the tramway undertaking, but that of the city generally, that the Sub-Committee suggested that full information should be obtained from all available sources. The Sub-Committee deemed it necessary that the general manager and the permanent-way engineer should be instructed to visit other cities, both in this country and abroad, and the Tramways Committee adopted a recommendation in this sense, but the City Council subsequently referred the matter back for further consideration. The Sub-Committee was more than ever convinced, after further consideration, that the procedure originally suggested was absolutely necessary, and it again recommends that the two officers named be instructed to visit the following cities at as early a date as possible, and that they be

directed carefully to study the various methods of passenger transportation adopted :—London, Glasgow, Paris, Berlin, Hamburg, Vienna, New York, Boston, Chicago, Philadelphia and Toronto. The Sub-Committee points out that delay is serious, because the traffic demands are so great that the Tramways Committee is forced to provide new rolling stock, and the outcome of the proposed inquiry may be that some modification in the existing types of rolling stock may be suggested.

In regard to the allocation of £100,000 to the relief of the rates from the Corporation tramways undertaking, the Finance Committee of the Corporation has pointed out to the Tramways Committee that, on the basis of 5 per cent. on capital expenditure, the tramways department should contribute £103,117 in rate relief. The Tramways Committee is protesting against the contribution of any greater sum than the £100,000 shown in the annual estimates, declaring that the effect of such a policy will be to cripple the development of the undertaking, and to prevent the granting of further improved facilities to the travelling public.

Newcastle-on-Tyne.—At a conference of the Institution of Municipal and County Engineers, Mr. J. McKellar, of Newcastle, contributed a paper on the tramway extensions of the city. He mentioned that there were about 60 miles single track, and they had cost about one and a quarter millions. With the exception of the first 20 miles, which were constructed under contract, all the work had been carried out departmentally. The present trolley system came into operation in December, 1901, and almost all the original rails and other material were still in use, evidence of the quality of the work. The only renewals carried out so far were about 500 yards on each side of two very steep gradients (worn out owing to the action of the magnetic brakes) and three of the original junctions. During the present year it was proposed to relay about two miles of route and seven junctions.

Nottingham.—The tramways undertaking shows a net profit of £24,775 for the last year, which is to be apportioned as follows: In aid of general district rate, £19,000; to reserve and renewals fund, £4,775; to reserve for removal of centre poles suspense account, £1,000. Traffic receipts during the 12 months amounted to £164,755, while advertisements brought in £2,200. Energy for power and lighting accounted for £30,003 of the total expenditure, which amounted to £108,273.

Swansea.—A deputation representing the Corporation, which has been to Halifax, Leeds and other places with the object of inspecting the working of tramways on steep gradients in order to decide on the best means of traction up Mount Pleasant, Swansea, has returned, and its members express themselves satisfied that a system of ordinary electric traction with overhead wires, recommended by Mr. Sellon, the Corporation's consulting engineer, will meet every requirement of efficiency and safety. There is a likelihood that the adoption of a central rail may be recommended as an additional precaution.

TELEGRAPH and TELEPHONE NOTES.

An International Wireless Telegraph Company.—An interesting development in international co-operation is afforded Télégraphie sans Fil, with a share capital of £90,000, divided into by the formation in Brussels of the Société Internationale de 4,500 shares of £20 each. The principal interests in the company are represented by Marconi's Wireless Telegraph Co. with 1,500 shares, the Gesellschaft für Drahtlose Telegraphie, of Berlin, with 1,500 shares and the Banque d'Outremer, of Brussels, with 800 shares.

Australia.—The Postmaster-General has stated that for three consecutive nights the operator on Macquarie Island, in the vicinity of the Antarctic Circle, has been able to maintain regular communication with the wireless stations at Port Moresby and Thursday Island—a distance of considerably over 2,000 miles.

Blind Telephone Operators.—In the United States trials have been made with blind girls as telephone operators, with remarkable success. It is stated that they carry out their duties more accurately than girls who are in possession of sight.

Crete.—It is proposed to enlarge the telegraph and telephone networks in the island of Crete at a cost of 105,000 fr. The orders for the material and instruments will be placed by the Greek Government.

Imperial Wireless System.—On Wednesday last week, Mr. F. Straker, assistant general manager of the London and South-Western Bank, was examined by the Select Committee on the Marconi contract regarding the statement of Mr. Powell, that a large syndicate had been operating in Marconi shares, which he denied *in toto*. Mr. Godfrey Isaacs banked with them, and opened a special account in connection with the American shares. There was no request for small notes. The total amount credited to the special account was about £150,000; £53,000 was withdrawn by Mr. Isaacs and paid to Marconi's Wireless Telegraph Co., the balance being cabled to New York in payment for the shares.

Mr. H. T. Campbell, broker to the Marconi Co., was recalled, and gave evidence regarding the dealings in shares. Mr. Godfrey Isaacs afterwards explained the transfer of moneys from his bank account to that of the company.

After the close of the public sitting, the Committee considered the desirability of presenting a special interim report on the questions affecting Ministers and others, and came to the conclusion that the time available before the rising of the House was not sufficient to enable it to do so. It was resolved that the evidence in regard to this part of the inquiry be concluded before the Whitsuntide recess, and that at the first meeting after the recess the Committee should proceed forthwith to the preparation of an interim report.

In the House of Commons the Prime Minister refused facilities to discuss a motion that the Committee be instructed to report on or before June 2nd.

On Monday Sir Albert Spicer, assisted by Mr. G. W. Knox, examined the pass-books of Mr. Lloyd George and Sir Rufus Isaacs.

The report of the Technical Committee appears elsewhere in this issue.

The Select Committee refused an application submitted by Mr. Maxse for a further hearing. A further sitting was held on Wednesday, when Mr. Marconi gave evidence.

India.—An automatic telephone system, which was recently inspected by numerous officials of the Government of India at Delhi, is to be introduced at Simla next cold weather.—*Indian Engineering.*

L.C.C.—The Post Office has given notice that the charges made to the Council under agreement with the National Telephone Co., for the services of the telephone operators at the private exchanges at the county hall and the education offices, have been revised. Under the existing arrangement the cost of the services of the operators, for which a charge of £598 a year is to be made in future, amounts to £401 a year, so that the increased cost to the Council will amount to £197 a year.

London Fire Alarms.—London is to be provided with a more modern system of fire alarms than those now in use, which are reported to be not of the best type. An officer of the fire brigade is to visit America for the purpose of inspecting and reporting upon the systems of fire alarms in use in the large cities.—*Daily Telegraph.*

Poulsen System of Wireless Telegraphy.—It is announced that the Canadian Government has introduced a Bill to ratify an agreement between the Dominion and the Universal Radio Syndicate for the establishment of wireless communication between Canada and England, on the Poulsen system. The company claims to be able to transmit at the rate of 80 words a minute, and to work day and night over a distance of 2,000 miles. The British station will be at Ballybunnion, Co. Kerry, and it is said that the system will be in operation in August next. Code messages will be taken at 8d. a word, ordinary messages at 4d., and Press messages at 2d. Code messages will not be given priority over private ones.

The Telegraph Service.—The Controller of the Central Telegraph Office has addressed a letter to the staff, stating that the service is in a state of transition, and urging the members to revise their methods and accelerate their procedure, in view of the growing competition of the telephone.

Telephonic Communication Between Vienna and Dalmatia.—About a year ago it was decided to establish telephonic communication between Vienna and Dalmatia, and the line—now completed—passes through Istria and over a number of islands in the Adriatic to the Dalmatian coast. The total distance from Vienna to Zara (Dalmatia) is about 510 miles. The overhead lines are of 5-mm. bronze wire, and the total length of the submarine sections of the line is 37 miles. The Krarup (distributed loading) construction was adopted in preference to the Pupin system of loading, owing to the numerous changes from submarine to overhead construction; the submarine cables were supplied by the Norddeutsche Seekabelwerke (Nordenham), whose tender was the lowest received. The cables contain four cores, each comprising a round central copper conductor surrounded by three strip conductors (total section 5·5 sq. mm.), overwound with three layers of 0·2 mm. soft iron wire, and covered with a special gutta-percha mixture to 8·4 mm. diameter. The conductors are stranded in pairs, which are then also stranded together. A brass tape covering is provided as protection against the teredo, while the armour consists of 24 galvanised iron wires of 5·7 mm. diameter on the deep sea, and of 207 ·1-mm. wires on the coastal, sections of the cable. No cable ship being available, the cargo steamer *Pera* was adapted to the work of laying the cable, which was effected without mishap, though the sirocco raged during part of the laying period.

On the completion of the line, it was found that communication between its ends was very satisfactory despite the considerable leakage from the overhead lines, which leakage was particularly severe on the islands owing to the collection of thick salt deposits on the insulators and posts. The two pairs of conductors in the submarine cables were free from mutual induction, so that no cross-talk was experienced. Before laying the submarine cable the two pairs of cores were placed in series for experimental purposes, and it was found that satisfactory communication could be effected through the 75 miles effective length of submarine cable thus obtained and 395 miles of landline. Recently satisfactory speech transmission has been secured between Vienna and Sarajevo (875 miles), although the overhead lines in Bosnia are only 3 or 4 mm. in diameter.—*E.T.Z.*

Wireless Station Burned.—The wireless station at Cape Race was destroyed by fire on Monday.

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CONTRACTS OPEN and CLOSED.

OPEN.

Australia. — Victoria. — May 30th. High-tension switchgear with remote control, for the Melbourne City Council. See "Official Notices" March 28th.

May 16th.—One 15-ton overhead travelling crane, for the Melbourne City Council. See "Official Notices" May 2nd.

June 2nd.—20,000-volt H.T. switchgear and L.T. switchgear and accessories, for the Melbourne Suburban Railways. See "Official Notices" May 2nd.

June 11th.—Switchgear and instruments, for the Melbourne City Council. See "Official Notices" April 25th.

July 8th.—Common-battery switchboard, for the P.M.G.'s Department. See "Official Notices" to-day.

Tasmania.—June 9th. Telegraph and telephone material for the P.M.G.'s Department. See "Official Notices" to-day.

Queensland.—May 21st. Copper wire and accessories, for the P.M.G.'s Department. See "Official Notices" April 11th.

August 27th.—Five sections of common-battery multiple switchboard, for the P.M.G.'s Department. See "Official Notices" to-day.

Western Australia.—May 28th. Condensing plant, pump and piping, for a Government power station at Perth. See "Official Notices" to-day.

July 9th and 30th and August 6th.—Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" to-day.

South Australia.—July 16th. Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" to-day.

Barnes.—May 19th. Feeder and distributor cables, for the U.D.C. See "Official Notices" April 25th.

Belfast.—May 19th. Circulating-water pump, for the Corporation Tramways and Electricity Committee. See "Official Notices" April 25th.

Belgium.—May 16th. The Direction des Ponts et Chaussées in Brussels (52, Boulevard du Regent) is inviting tenders for an installation of electric lighting in the Public Park at Laeken. Particulars may be obtained from the Engineer, 15, Rue des Augustins, Brussels.

Birkenhead. — May 19th. Corporation Electricity Department; tenders for washed slack or washed small coal, for 12 months, commencing July 1st, 1913. Electrical engineer, Mr. W. Wyld, Craven Street.

Bootle.—May 13th. Boiler and pipe coverings for Marsh Lane electricity works. Borough Electrical Engineer's Office, Pine Grove.

Bradford.—May 15th. The Education Committee invites tenders for electrical work and fittings at the Belle Vue Boys' Secondary School and the School for Deaf and Cripple Children, Lister Lane. Tenders to the Director of Education, Town Hall.

Bulgaria.—May 21st. The District Administration of Finance in Sofia is inviting tenders for a double electrically-operated winding cage with all accessories, for the State Collieries at Pernik.

Derby.—May 23rd. One 750-kw. motor-alternator, for the Corporation. See "Official Notices" to-day.

Germany.—May 21st. The Prussian State Railway authorities at Konigsberg are inviting tenders for two 30-cwt. electrically-operated coal-loading cranes.

Glasgow.—May 26th. Two steam turbo-alternators, with condensing plant (5,000 kw. and 2,000 kw. respectively), for the Corporation Tramways Department. See "Official Notices" April 25th.

Grimsby.—Pipework, extension of Klein cooling towers, conduits, seven-way D.P. distribution board and motor-driven rotary air and water extraction pumps and circulating pump, for the Corporation. See "Official Notices" May 2nd.

Leeds.—May 19th. Economiser chamber at the generating station, Whitehall Road; extension of engine room flooring at generating station, Whitehall Road. Specifications, &c., from 1, Whitehall Road, Mr. C. N. Hefford, engineer.

London.—May 9th. Electrical installation at Wilton Road Central Elementary School, Hackney. See "Official Notices" April 25th.

May 13th.—One 20-ton overhead hand crane, for the Shoreditch sub-station. See "Official Notices" April 25th.

L.C.C.—May 28th. Electrical installations at Lewisham Bridge and Fairfield Road (Bow) elementary schools. See "Official Notices" to-day.

Applications are invited from persons and firms wishing to be included among those from whom the Council invites tenders for the supply of stores and the execution of general maintenance contracts. See "Official Notices" to-day.

Mile End.—Two 30-kw. and one 15-kw. compound engines and dynamos, for the Guardians (from municipal authorities only). See "Official Notices" to-day.

Malta.—May 22nd. Arc lamp carbons. Receiver-General and Director of Contracts, Valletta. Forms, &c., from Crown Agents for the Colonies, Whitehall Gardens, S.W.

Manchester.—May 13th. Electric light installation at Withington Workhouse. Specification and particulars obtainable from Mr. F. H. Overmann, architect, 49, King Street, Manchester.

Mexborough.—May 30th. Lancashire boiler, for the U.D.C. electricity department. See "Official Notices" April 25th.

New Zealand.—Christchurch.—May 22nd. City Council. Two 500-kw. converters and switchboard panels. Tenders, c.i.f. Lyttelton, to office of High Commissioner for N.Z., 13, Victoria Street, S.W. Specification, &c., at Board of Trade C.I. Department in London.

Norway.—May 14th. Norwegian State Telegraph Department. Copper wire, insulators and soldering tin. Local representation. Copies of the specifications may be seen at the C.I. Branch of the Board of Trade, London.

Peterborough.—The Council is about to invite tenders for two steam boilers and a steam turbine and generator.

Paris.—May 13th. Tenders are invited for the electrical high-tension equipment to be established at the sub-station at Meudon-val-Fleury. Particulars, Bureaux du Service Electrique (2-m. Division), 43, Rue de Rome, Paris.

May 17th. Supply of 200,000 liquid pile elements, in four lots. Particulars, Direction de l'Exploitation Téléphonique, 103, Rue de Grenelle, Paris.

Plymouth.—May 13th. Steam coal (8,500 tons), for the Corporation Electricity Department; Mr. E. G. Okell, Borough Electrical Engineer, Prince Rock (returnable deposit of £1).

Rathmines and Rathgar.—May 19th. Electrically-driven jet condensing plant, for the U.D.C. See "Official Notices" May 2nd.

Rochdale.—May 14th. Electrically-driven induced-draught plant, for the Corporation electricity department. See "Official Notices" April 25th.

May 21st.—Boiler feed pumps, for the Corporation Electricity Committee. See "Official Notices" May 2nd.

Salford.—May 19th. Tenders invited for 10 car bodies and 10 Brill trucks. Tramways General Manager, 32, Blackfriars Street, Salford.

South Africa.—Stellenbosch (Cape Province).—June 4th. The Municipality is requiring tenders for buildings, generating plant, cables, public lighting, meters, &c., in connection with the electric lighting scheme. Specifications from Prof. Bohle, South African College, Cape Town.

Spain.—May 23rd. The municipal authorities of Montilla (province of Cordoba) are inviting tenders for the concession for the electric lighting of the town during a period of 20 years.

Walthamstow.—May 28th. Natural draught cooling tower, for the U.D.C. Electricity Department. See "Official Notices" May 2nd.

Warrington.—May 13th. Traction battery and reversible booster, for the Corporation. See "Official Notices" April 25th.

May 13th.—Feeder pillars and high and low-tension cables, for the Corporation. See "Official Notices" May 2nd.

CLOSED.

Australia.—Sydney.—The *Australian Mining Standard* records the acceptance of the following tenders by the Municipal Council:—

Feeder Cables.—B.I. & Helsby Cables Ltd., £276; Noyes Bros., £3,953; Henley's Telegraph Works Ltd., £4,018.

Underground Cables.—B.I. & Helsby Cables Ltd., £11,721, and the following as per schedule tendered; Siemens Bros., Western Electric Co., Henley's Telegraph Works, Noyes Bros.

Motors.—British Westinghouse Electric Co., Gardner, Waern & Co., Union Electric Co., Australian General Electric Co., Australian Metal Co., Siemens Bros., all as per schedule tendered.

The same contemporary records the following results:—

P.M.G.'s Department, Adelaide:—

32 tons H.D. copper wire, 106 tons galvanised iron wire.—R. Johnson, Clapham & Morris, Ltd.

P.M.G.'s Department, Melbourne:—

Bells, induction coils and fuses, I.R., G.P. & T. Works Co. 33 miles paper-insulated cable, Australian Metal Co. Bells, fuses, telephone apparatus, switchboards, &c, J. Bartram & Son, Ppy., Ltd.

P.M.G.'s Department, Perth:—

About 9 miles lead-covered, paper-insulated telephone cable (£8,899), Imperial Electrical Engineering Co., Perth. Telegraph cable (2,165 ft.), B.I. & Helsby Cables, Ltd.

According to *Tenders*, the Home Affairs Department has ordered the steel frame for power generating station, Federal capital site, at £6,345, from Messrs. Johns & Waygood, Ltd., Melbourne, and one Green's patent economiser, for Federal capital, at £1,292, from Babcock & Wilcox, Ltd.

Barrow.—The Council, on Monday, decided to relieve Messrs. Ship Carbons, Ltd, from their contract for supplying yellow-flame carbons, and agreed that the tender of Messrs. Engineering and Arc Lamps, Ltd., be accepted. In regard to the supply of copper wire and carbon-filament lamps, it was decided to inform Messrs. Thos. Bolton & Sons, Ltd., and the Radium Electric Co. that the Electricity Committee regret that they cannot make any alteration in their tenders, and that they be requested to supply such goods as may be ordered in accordance with their tenders.

Belfast.—The Corporation, last week, accepted the tender of Messrs. Babcock & Wilcox, Ltd., at £2,805, for an additional boiler, superheater, mechanical stoker and pipework for the electricity works.

Belgium.—The municipal authorities of Schaerbeek, Brussels, last week opened tenders for the supply and installation of 11 transformer boxes in connection with the electric lighting undertaking. Six concerns—four Belgian, one French and one German—competed for the contract, the lowest tender being that of the Société A.E.G. Union Electrique, of Brussels.

Bexhill-on-Sea.—The T.C. has sealed an agreement with the Tudor Accumulator Co., for the maintenance of the batteries for 10 years.

Blyth.—The tender of Messrs. Resive & Co., of Brignouse, has been accepted for the E.L. installation at the new Government buildings at Blyth.

Bolton.—The Corporation Tramways Committee has accepted the tender of Messrs. Milnes, Voss & Co. for ten additional top covers for double-deck cars.

The Electricity Committee has accepted the following tenders :—

W. Gornall.—Reservoir construction in connection with the new generating station.
Bertram Thomas.—Sub-station equipment.
S.Talbot & Sons.—Two chimney stacks.
B.I. & Helsby Cables, Ltd.—Wires and cables.
F. & J. Webster.—Casings.

Bradford.—The Corporation Electricity Committee has accepted the tender of Messrs. Ferranti, Ltd., to supply E.H.T. switchgear required for the transformer chamber at Montserrat Mills, for £215. The Committee has authorised an alteration in the supply in the Manchester Road district, south of Bowling Old Lane, from direct current to alternating current, involving the provision of new cables, relaying of single-core cables, &c., at a cost of £450.

The following tenders have also been accepted :—

Bertram Thomas.—Three-phase A.C. and D.C. switchgear required for new sub-stations at Thornbury and Odsal, £2,075.
Underfeed Stoker Co., Ltd.—Two Underfeed stokers for boilers at Valley Road Works, £728.
Babcock & Wilcox, Ltd.—Two chain-grate stokers for boilers, £800.
Taylor Bros., Ltd.—50 nickel-chrome-steel tramcar axles, £4 5s. 9d. each.

Bridlington.—The Electricity Committee has placed an order with the Brimsdown Lamp Works, Ltd., for lamps for a year, at prices quoted.

Bristol.—The Electrical Committee reported to the Council, on Tuesday, that it had entered into the following contracts for 1913-14 :—

W. Lucy & Co., Ltd., fuse boxes	£104
Sykes & Sugden, Ltd., joint and junction boxes	480
Oliver Arc Lamp, Ltd., yellow flame arc lamp carbons	301
Sloan Electrical Co., Ltd., open-type arc lamp carbons	371
Ferranti, Ltd., D.C. meters	308
British Westinghouse Co., Ltd., A.C. meters	1,069

Brighton.—The T.C. has accepted the following tenders :—

Richardsons, Westgarth & Co., Ltd., turbine (3,000 B.P.M.) coupled to a Siemens 3,000-KW. alternator, complete with waters spray filter, air pump, and augmentor condenser with 200 sq. ft. of cooling surface, £7,291.
Greenwood & Batley, Ltd., for a De Laval motor-driven turbine pump, with switchgear, at £276.

Broadstairs and St. Peter's.—The U.D.C. has referred the following tenders for the installation of electric fire alarms to a Committee for consideration :—

Stuart & Moore.—Without telephones, £190 10s., and £12 per annum for maintenance; with complete telephone apparatus £218, and maintenance £14 a year.
Siemens Bros.—£139, exclusive of fixing and wiring.
Walter Electrical Manufacturing Co., Ltd.—£228 complete.
Mr. G. Longfield.—£158, exclusive of wiring and maintenance.

Buenos Ayres.—Two engines of 240 B.H.P. each for the Provincial Electric Lighting Co., of Buenos Ayres, have been ordered from Messrs. Hick-Diesel Oil Engines, Ltd.

China.—The *Indian and Eastern Engineer* states that there has recently been formed in the little city of Fatshan, near Canton, a company to undertake the supply of electric lighting and power. A British firm, the General Electric Co. of China, Ltd., has secured the principal contract in connection with the installation. The generating plant which the G.E. Co. is to supply will consist of three three-phase high-tension A.C. generators with an overload capacity of about 200 KW., driven by crude-oil Bolinders engines. The plant, which will go from Witton, will arrive in July and should be ready for starting by the end of the year. "Much difficulty has been encountered in the choice of a suitable site for the power station. Fatshan lies very low, and to avoid the possibility of occasional flooding, it has been found necessary to raise the ground on which the building is to be erected some 5 ft."

Coventry.—The Corporation has accepted the tender of the Brush Electrical Engineering Co. for five double-deck tramcars with four-wheeled trucks.

Dewsbury.—The Electricity and Tramways Committee has accepted the tender of the Union Cable Co., of Dagen Dock, for 1 mile of electric cable.

Doncaster.—The Electricity Committee recommends the acceptance of the following tenders for six new cars :—The United Electric Car Co., Ltd., for car bodies, with top covers, at £456 each. The Peckham Truck Co., for pendulum trucks, at £90 each, and Dick, Kerr & Co., for electrical equipments, at £284 each.

Dukinfield.—Messrs. C. Benyon & Co., a local firm, have received the contract for installing electric light at the Primitive Methodist New Sunday School, Foundry Street.

Eccles.—The Electricity Supply Committee has accepted the tender of Messrs. F. Danks, Ltd., Oldbury, for a Lancashire boiler for the electricity works for the sum of £410.

Germany.—Messrs. Nagel & Kamp, of Hamburg, have secured a contract from the Finance Deputation, of Hamburg, for the supply and erection of four electric cranes, at a cost of £4,015.

Glasgow.—The Clyde Navigation Trustees have agreed to accept the following tenders for the material required for the erection of 10 electric capstans at Renfrew :—

Motors.—Laurence Scott & Co., Ltd., at £360.
Iron castings.—Fullerton, Hodgart & Barclay, Ltd., at £203.
Steel castings.—Carntyne Steel Castings Co., at £116.
Controllers and resistances.—British Westinghouse Co., Ltd., at £262.

Holland.—Messrs. Cassirer & Co., of Charlottenburg, Germany, have secured a contract from the Provincial Administration authorities at Groningen for the supply of 68¾ miles of electric cables, for the round sum of £24,000.

Keighley.—The Electricity Committee has accepted the tender of Messrs. Hird Bros. & Co., at £139, for work in constructing a concrete foundation for a new 2,000-KW. turbo-alternator.

Liverpool.—The T.C. has accepted the following tenders for supplies to the Electricity and Tramway Departments :—

British Thomson-Houston Co., Ltd.—Two 6,000-KW. turbo-alternators.
Joshua Henshaw & Sons.—Alterations at the Lister Drive electric power station.
Pearson Huggins & Co., Ltd.—1,500 pairs of drivers' and conductors' winter trousers.
British Westinghouse Electric and Manufacturing Co., Ltd.—Three sets of rotary converters and accessories.

London.—L.C.C.—The following were the tenders received during the election interval and the Easter recess for the electric lighting of the Avery Hill Training College Hostels :—

H. J. Cash & Co., Ltd.	(accepted) £1,189
Pinching & Walton	1,199
Tredegar & Co.	1,209
Williams & Bach	1,240
G. E. Taylor & Co.	1,366
W. C. Tackley & Co., Ltd.	1,425
G. Weston & Sons, Ltd.	1,463
Malcolm & Allen, Ltd.	1,517

(Architect's estimate, £1,068.)

The Fire Brigade Committee is accepting the tender of the "Cedes" Electric Traction, Ltd., for a petrol-electric motor chassis required for converting a horsed turntable long ladder into a petrol-electric motor appliance, at £850. The company will sub-let the motor engine to the Aster Engineering Co., Ltd.

The following tenders were received by the Highways Committee for two 8,000-KW. turbo-generators and auxiliaries, required for the Greenwich generating station :—

Name.	Maker of generator.	Amount of tender.
Escher, Wyss & Co., Zurich	Siemens	£48,012
British Westinghouse Electric, &c., Co., Ltd.	Brit'sh Westinghouse, &c., Co.	50,532
Willans & Robinson, Ltd. and Red.	Siemens	50,560
Richardsons, Westgarth & Co., Ltd.	Brown, Boveri	51,610
Fraser & Chalmers, Ltd., Erith	Brown, Boveri	52,989
Willans & Robinson, Ltd. and Red.	General Electric	53,710
Willans & Robinson, Ltd. and Red.	Dick, Kerr	53,720
Fraser & Chalmers, Ltd.	Siemens	54,889
Richardsons, Westgarth & Co., Ltd.	Siemens	54,861
Jas. Howden & Co., Ltd.	Siemens	55,342
Richardsons, Westgarth & Co., Ltd.	General Electric	58,259
Fraser & Chalmers, Ltd.	General Electric	58,289
Brush Electrical Engineering Co., Ltd.	Brush	60,500
C. A. Parsons & Co.	C. A. Parsons	64,989
British Thomson-Houston Co., Ltd.	British Thomson-Houston	70,224
Belliss & Morcom, Ltd.	Siemens	70,770

The Committee reports upon these offers as follows :—"The above prices are subject to an increase or decrease resulting from a bonus or penalty on steam consumption, such bonus or penalty being at the rate of £500 per tenth of a pound of steam less or more than 12·75 lb. per KW.-hour at full load. The estimate of the chief officer of tramways was £62,500. Having regard to the very great importance of obtaining the best possible type of plant for the generating station, the chief officer of tramways consulted an expert as to which of the tenders would be most satisfactory from the Council's point of view. Sir Alexander Kennedy was asked to advise on the matter, and he has carefully examined each of the tenders received. As the result, Sir Alexander Kennedy, after discussing the matter with the chief officer of tramways, has advised that the second lowest tender, that of the British Westinghouse Co., amounting to £50,532, should be accepted. One of the most important considerations involved in coming to a decision as to the tender to be accepted is that of steam economy, and the figure submitted by the British Westinghouse Co. is 12·44 lb. of steam per KW.-hour at full load, which, we are advised, is satisfactory. The corresponding figure offered by Messrs. Escher, Wyss & Co. is 12·82 lb. per KW.-hour, subject to an allowance of 3 per cent. either more or less. On the assumption that both sets of figures were obtained in actual operation, the extra steam required by the two Escher, Wyss turbines would represent an additional expenditure for coal of about £1,500 a year at present prices. We accordingly propose that the

tender of the British Westinghouse Co. should be accepted. An additional provisional sum of £4,000 for transformers will be included in the contract. The company stipulates that certain modifications shall be made in the clause usually inserted in the Council's contracts as regards the submission to arbitration of any disputes arising thereunder. We are of opinion that the clause, as amended, is substantially in agreement with the standard clause in the Council's usual form of contract."

It is proposed that the tenders for additional water condensing pipes, &c., be opened during the Whitsuntide recess, and that the chairman or vice-chairman have authority to accept the lowest satisfactory one.

The tender of Messrs. A. Ransome & Co., Ltd., for a pedestal type rounding machine for the third section of the central car repair depôt, at £66, is recommended for acceptance.

WATER BOARD.—The following tenders have been accepted by the Metropolitan Water Board :—

General Electric Co., Ltd.—Various electric fittings for Hampton Station, £41; ditto, for Surbiton Station, £44; one power panel and fittings, £39.
Simplex Conduits, Ltd.—Tube ends, switchboxes, lampholders, &c.

MARYLEBONE.—The tender of Messrs. Parsons has been accepted by the B.C., at £230, for a new spindle for a turbine at the generating station. The tender of Messrs. Blackmore & Co. has also been accepted for the supply to the Electricity Department of 120 tons of Baddesley beans at 15s. 11d. per ton.

ASYLUMS BOARD.—The Metropolitan Asylums Board has accepted the tender of Mr. H. J. Godfrey, at £322 10s., for wiring certain portions of the Grove Hospital.

HAMMERSMITH.—The Electricity Committee proposes to enter into a contract with the Main Colliery Co., of Neath, for free burning coal, similar to that supplied under the existing contract, for one year, at 17s. 6d. per ton. This is 10d. per ton advance.

SHOREDITCH.—The Lighting Committee report that during the annual overhaul of engines at Whiston Street, while No. 2 Wallsend engine was dismantled they received an offer from Messrs. Allen and Simmonds, Ltd., of Reading, to bore out the valve chambers and provide a full set of eight valves for £299, also making and fitting a 24½-in. diameter self-contained Bull piston ring, fitted with Allen "patent" frictionless rings and springs complete for H.P. cylinder, and a 53¼-in. ditto for L.P. cylinder, also boring out L.P. cylinder of above engine, for £156. Messrs. Allen & Simmonds, Ltd., guaranteed to reduce the steam consumption to 19½ lb., which was equal to an efficiency of nearly 10 per cent. better than when the engine was new, and the improvements effected will be sufficient to return the whole cost within a few months. The Committee, therefore, ordered the work to be put in hand.

G.P.O.—The G.P.O. contract with the General Electric Co., Ltd., for the supply of Osram lamps has been extended for a further period of six months.

LEWISHAM.—The B. of G. on Monday again considered the tenders for the electric installation at the workhouse. The Works Committee reported that a letter was written to Messrs. Tredegar inquiring if they were willing to execute the work for £668, the amount quoted in their tender. In reply, Messrs. Tredegar referred to the Guardians' proposal to accept their tender for part of the work only, but their estimate was based on the assumption that they should receive the order for both the infirmary and the workhouse. If, as they understood, the Guardians proposed to accept only one part of the estimate, viz., the workhouse, they would require an increase of 5 per cent. on the price originally quoted to cover the increased cost of supervision and establishment charges. This would make their tender £701. The Works' Committee reported that they were of opinion that as Messrs. Tredegar were not willing to adhere to their original tender, and now increased their price after publication of the amounts of the tenders submitted to the board, the tender of Messrs. Haycraft & Son, Ltd., Brockley, be accepted for £759. Mr. W. Ross submitted that the board ought to accept the lowest price, that of Messrs. Tredegar. Mr. A. O. Weeks pointed out that if the tenders for the two institutions were added together Messrs. Tredegar were not the lowest. Mr. H. M. Clemow inquired why they should spend £59 of the ratepayers' money in this way. A proposal to accept Messrs. Tredegar's revised tender was defeated, and the board, by 18 votes to 9, accepted the tender of Messrs. Haycraft.

FULHAM.—The B.C. has accepted the offer of Messrs. Phillips and Co., Ltd., for the supply of 1,450 tons of Kirkby nutty black steam coal, at 13s. per ton.

Leyton.—The U.D.C. has accepted the tender of Messrs. Siemens Bros. Dynamo Works, Ltd., at £780, for the supply of a spare lighting armature, and at £795 for a spare traction generator armature. The tender of the General Cable Manufacturing Co. has also been accepted, at £456, for one mile of ·2 sq. in., half-mile of ·025 sq. in., and half-mile of ·0125 sq. in. cable. Other tenders were received from the following :—

Union Cable Co., Ltd.	£444
R. R. Todd	451
Electrical Engineering and Equipment Co.	454
Standard Cable Co., Ltd.	467
Pirelli, Ltd.	477
Johnson & Phillips, Ltd.	498
General Electric Co., Ltd.	501
B.I. and Helsby	501
Siemens Bros. & Co., Ltd.	504
Glover & Co., Ltd.	505
Callender's Cable Co., Ltd.	507
W. T. Henley's Telegraph Works Co.	516

Luton.—The tender of Mr. A. J. Pitkin, Luton, has been accepted for the electric light installation at new club premises being erected in Dunstable Road.

Peterborough.—The T.C. has accepted a tender by W. T. Henley's Telegraph Works Co., Ltd., for cable for Westgate, at £567.

River Plate.—The Minister of Public Works has accepted the tender of the Sociedad Gasmotoren Fabrik Deutz for the electric light installation in the Reformatory at Marcos Paz, at $19,702.

Messrs. Siemens Bros. have obtained the contract for all the switchgear at the power house that the Western Railway Co. are building in Dock Sud in connection with the electrification of their suburban lines.—*Review of the River Plate.*

Salford.—The following tenders have been accepted by the T.C. :—

British Westinghouse Electric Co., Ltd.—Extra-high-tension three-phase switchgear with control board, £1,765.
General Electric Co., Ltd.—Two Aron meters.
Siemens Bros. Dynamo Works, Ltd.—Two induction meters.
British Electric Transformer Co., Ltd.—Three compensator transformers, £299.

The following tenders have also been accepted for annual supplies to the Electricity Department :—

W. T. Glover & Co., Ltd.—I.-R. cables, £150; multiple core cables, £300.
Wm. Geipel & Co., Ltd.—India-rubber cables, £200; twin flexible cable and plain white tape.
John Bassett.—Tin and lead, £150.
Albion Clay Co., Ltd.—Stoneware conduits and pipes, cable protectors, &c., £70.
W. H. Keys, Ltd.—Bitumen, £240.
W. T. Henley's Telegraph Works Co., Ltd.—Rubber strip, £72.
Bell's United Asbestos (Northern Agency).—Asbestos packing, millboard, &c., £20.
Grove Asbestos Works Co., Ltd.—Rubber insertion, &c.
L. Andrew & Co.—Flake graphite, mica, rubber gloves, rubber caps, £24.
T. Hart.—Cotton driving rope, £46.
J. Cookson, Ltd.—Tarred twine.
Bell Bros.—Crank chamber oil, £393.
M. Wells & Co.—Turbine oil and charcoal refined cylinder oil, £110.
Stern Sonneborn Oil Co., Ltd.—Black oil, £50.
Baxendale & Co.—Wrought-iron tubes and fittings, £60.
F. A. Ellis.—Fire bricks, fire clay, &c., £22; cement, £52.
North British Rubber Co., Ltd.—Rubber overshoes.
Lancaster & Tonge.—Brass, &c., fittings.
Brunner, Mond & Co., Ltd.—Soda ash, £41.
Hall & Pickles.—Iron and steel bars, plates, &c., £46.
W. Higgins & Son.—Chamber bricks, £5.

Sheffield.—The Corporation has accepted the tender of the Brush Electrical Engineering Co., for 25 double-deck tramcars with top covers and four-wheeled trucks.

Swindon.—The Wilts. C.C. has accepted the tender of Messrs. Lott & Son for installing the electric light at the police buildings at Swindon, at £149.

Winchester.—The City Council has accepted a tender by Messrs. A. Reyrolle & Co., Ltd., for a new switchboard for the electricity works, for £824.

FORTHCOMING EVENTS.

Royal Institution.—Saturday, May 10th. At 3 p.m. Lecture on "Humphrey Internal-combustion Pumps," by Mr. H. A. Humphrey. (Lecture I.)
Saturday, May 17th. At 3 p.m. Lecture on "Humphrey Internal combustion Pumps," by Mr. H. A. Humphrey. (Lecture II.)

Institution of Electrical Engineers (Yorkshire Section).—Wednesday, May 14th. Meeting at 7 p.m. At the University, Leeds.

Association of Electrical Station Engineers (Manchester Section).—Thursday, May 15th. At 7 p.m. At the Crown Hotel, Manchester. Paper on "The Status of Electrical Station Engineers and the Need of an Association," by Mr. J. W. Thomas.

Salford Technical and Engineering Association.—Thursday, May 15th. Whit-week tour in Wales.

Physical Society.—Friday, May 16th. At 8 p.m. At the Imperial College of Science, South Kensington, S.W. Paper on "Some Experiments to Detect β-rays from Radium A," by Drs. W. Makower and S. Russ.

Junior Institution of Engineers.—Friday, May 16th. At 39, Victoria Street, S.W. Discussion on "Electrical Propulsion of Ships," introduced by Mr W. P. Durtnall.

The B.A. Meeting.—Sir Oliver Lodge, the president of this year's meeting at Birmingham, will deliver his address on the evening of Wednesday, September 10th, in the Central Hall, Corporation Street. One of the evening discourses will be delivered on Friday, September 12th, by Sir H. H. Cunynghame, on "Explosions in Mines and the Means of Preventing Them." The Town Hall will be the Reception Room, and the various section rooms will be in the surrounding buildings. On the Saturday there will be many excursions, places to be visited including Stratford-upon-Avon, Warwick Castle, Stoneleigh Abbey, Kenilworth Castle, Bromsgrove, Hartlebury Castle, Tewkesbury, Worcester, the Forest of Arden, Malvern, &c. The honorary secretaries (the Council House, Birmingham) will issue a list of hotels and lodgings in due course.

Newcastle proposes to invite the Association to meet there in 1916.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION)

Commanding Officer—Lieut.-Col. H. M. Leay.

The following orders have been issued for the current week :—

Monday, May 12th.—Headquarters will be closed.

Tuesday, May 13th.—Headquarters will be closed.

Wednesday, May 14th.—All Companies. Annual course of musketry at Purfleet rifle ranges. Railway tickets will be sent to those notifying headquarters of their intention to attend.

Thursday, May 15th.—"C" Company. Infantry drill, 7 to 9 p.m.; technical instruction for all members on the 6th rate, and for all candidates for higher rating, 7 to 9 p.m.; musketry instruction, 9 to 10 p.m.

Friday, May 16th.—"D" Company. Ditto.

Saturday, May 17th.—Annual musketry as for Wednesday, May 14th. Headquarters will be opened for regimental business from 10 a.m. till 12 noon.

(Signed) P. H. Campbell, Capt. R.E., and Adjt.
For Officer commanding L.E.E.

NOTES.

Wanted—Six Hundred Pounds.—Our readers are already aware that at the annual festival dinner Mr. E. G. Byng offered to give £100 to the funds of the Electrical Trades Benevolent Institution if nine other firms or gentlemen would do the same within three months from April 16th. The £100 which Mr. Sutton had already given was to be counted as one of the nine; Mr. H. Hirst, through Mr. Sutton, promised a like amount; and Mr. Garcke's promise brings the total up to £400 out of the required £1,000.

It has been thought that some of our generously disposed readers would be willing to follow the splendid example set by these gentlemen and ensure that the conditional offers are fulfilled by making or influencing six other offers. We hope that in later issues it will be possible for us to fill names into the six spaces now standing vacant below :—

1	Mr. E. G. Byng	£100
2	Mr. G. Sutton	£100
3	Mr. H. Hirst	£100
4	Mr. E. Garcke	£100
5	*	
6	*	
7	*	
8	*	
9	*	
10	*	

Electricity from the Air.—A Manchester paper announces that Councillor J. W. Cook, who has just returned from a tour in America, has acquired some of the patent rights in a marvellous invention, which he came across in the course of his travels. The inventor collects electricity from the air, after the style of Benjamin Franklin, but with an apparatus which is obviously a vast improvement on the primitive kite, for it consists of the following parts :—

"The electrical absorbers or accumulators, which are composed of zinc plates and magnetised steel, or may be composed of peculiarly treated and magnetised steel only; the compound-rectifying exciter transformers; the automatic governor, circuit breaker, or lightning arrester; and the tower. The switchboard ammeter, voltmeter, switch and insulations complete the list of parts.

"The wiring of the machine is not unlike that of any electrical machine except that no copper wire is used until the point is reached where the electric energy is ready to be delivered for use. The compound-rectifying exciter transformers perform the function of preparing the ambient elemental electric forces, after being gathered by the accumulator for use. These compound-rectifying exciter transformers are susceptible of being adapted to the varying requirements found to exist under various climatic conditions, so as to increase the voltage and lower the amperage, or increase the amperage and lower the voltage as desired. The real secret and technical points of this part of the invention, as well as the accumulators, will be given to the world at large as soon as the last applications for foreign patents have been accepted."

It is clear that we have here a discovery of fundamental importance, destined to revolutionise the electrical industry. That theory has not been neglected is evident from the following statement :—

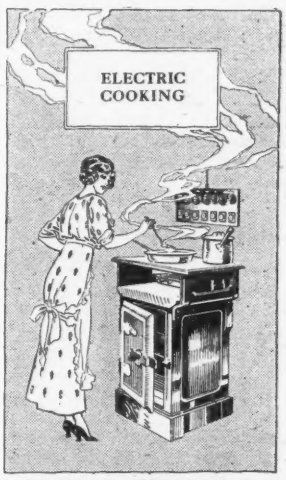
"The success of this invention, like that of all dynamos, depends upon the natural law that electricity produces magnetism, and magnetism produces electricity. The inventor, however, claims to have made a new application of this natural law, which will completely revolutionise electric science and necessitate a re-writing of electrical text-books."

It is quite usual for inventors of revolutionary devices to upset the text-books; epoch-making discoveries of this kind are almost necessarily contrary to the laws assumed by ordinary scientists to be universally true, such as gravitation and the conservation of energy, but considerations such as this cannot be allowed to hamper progress.

"The inventor authorises a statement that his machine produces a continuous direct current, and is protected against surplus charges such as lightning, by a circuit-breaker or lightning arrester which safely delivers surplus charges of electricity to the earth; that he has proved that electricity and lightning are one and the same thing, as believed to be the case by Benjamin Franklin; that lightning has been tamed and made to serve man."

Franklin is to be congratulated upon the vindication of his pet theory, which at least survives the wreck of the text-books; and we pay respectful homage to Councillor Cook, our coming multi-millionaire, who will in the future control the shafts of Jupiter Tonans and create a corner in domesticated lightning.

Point Five Publicity.—The accompanying illustration shows the poster which has been got out by the "Point Fives," as mentioned in our last issue, in the absence of a suitable design from



Electricity for Cooking at ½d. per unit.

what they call the "moribund" Electric Publicity Committee. Simplicity is the key-note of the design, which clearly implies that the lady of the house is doing the cooking herself.

Concert.—The annual prize distribution of the Devon (Fortress) R.E. Electric Light Companies was held in connection with a smoking concert at Mutley Barracks, Plymouth. Colour-Sergeant-Major Pearks presided, and was supported by the commanding officer (Major W. E. P. Bastard) and other officers. "The Officer Commanding and Officers" was given by Sergeant Rowe. Major Bastard, replying, remarked that they had heard so much about the Territorial Force recently, that some of them had begun to wonder where they were, and if they were anywhere at all. There had, however, been a lot of exaggerated statements made, and he doubted whether the force was in such a parlous state as some would have them believe. They were up to strength, if not over, in the Works Companies, which did not accept any but exceptional men and those particularly wanted. He wished the Electric Light Companies were up to strength. They had had a nasty knock in not being able to take men from the dockyard. A delightful musical programme was enjoyed.

Cold Light.—Some time ago we commented on an invention of Prof. C. F. Dussaud, which was shown before the French Academy of Science, under the ægis of Prof. Branly. Last week the working of the system, which is called "Cold Light," was demonstrated at the offices of Messrs. Louis Schloss & Co., London, in its application to cinematographs, projection lanterns, lighthouses, and other lighting uses. The fundamental idea is *rest*; the inventor claims that by running metallic-filament lamps at an excessive voltage, say, 100 per cent. above normal, for very short intervals he is able to secure an extremely high efficiency, and a powerful light from a small lamp, without causing the bulb to grow hot and without destroying the filament. This is effected either by interrupting the current flowing to a single lamp or group of stationary lamps, or by fixing several lamps on a revolving disk with a contact-maker which causes each lamp to light in succession whilst passing a fixed point. In the latter case, the lamps appeared as a ring of light, thus proving that the filaments had not time to grow cold between-times. In the case of the cinematograph, a single lamp is used, which is alternately lighted and extinguished, and the film is moved during the extinction, so that the revolving shutter ordinarily used to cut off the light of the arc lamp while the film is moved is dispensed with.

In the case of the projection lantern, three lamps are mounted on a revolving frame; one lamp is lighted for the exposure of a view, and may remain alight, we were told, for as much as 1 or 2 min. On changing the view, the operator also changes the lamp by rotating

the frame, and thus each lamp will burn (at excess voltage) for one minute out of three, or two out of six.

The life of a lamp thus used is said to be about four hours in the aggregate, which, of course, corresponds to a continuous display of pictures lasting 12 hours. A lamp taking 25 watts under these conditions was shown to be as effective as an arc lamp taking 10 amperes at 100 volts, of which perhaps 500 watts was expended in the arc.

When the system is used for lighthouses, with revolving beams, a large lamp is used, with a revolving screen, and during part of the revolution the lamp is extinguished, giving the bulb a chance to cool. It is claimed that, thanks to the coolness of the source of light, small lenses can be used close to the lamp, thus effecting a very great economy in cost. A lamp intermittently lighted about 50 times a second, while fed with current at 100 per cent. above normal voltage, and fixed in a suitable reflector, gives a splendid light. We understand that the system is being adopted by numerous theatres and restaurants in France, and by the French Government.

The demonstration was mainly qualitative, and not quantitative, and we are not in a position to give reliable data as to the efficiencies, temperatures, &c. We formed the opinion, however, that the essence of the matter was the use of an excessive voltage, and that interruption of the current was of little consequence. Lamps thus over-run can be kept cool in various ways. Of course, the efficiency of any incandescent lamp when heavily over-run is extremely high, and while the life under such conditions must necessarily be brief, there is certainly a valuable lesson to be derived from these experiments. It is this: It may be a highly economical plan to use metallic-filament lamps for cinematographs, projection lanterns, searchlights, photographic projectors, and all such purposes for which long-continued illumination is not necessary; to run them at an excessive voltage and corresponding candle-power, and replace them when burnt out—instead of using arc lamps.

The fact that an intermittency so high as 50 per second is used in some cases, equal in effect to an alternating current at 25 cycles per second, shows that the intermittency has no material importance; and this is emphasised by the fact that sometimes the rate of intermittency is only once in three minutes. Hence the over-voltage is the only essential feature of the "system."

Electrical Workers' Wages.—A letter has been forwarded to the Bolton Electricity Committee by the secretary of the Electrical Trades Union making application on behalf of members in the employ of the department for an advance of 1d. an hour on the present rate of wages. The fittings superintendent was requested to obtain further information and report to the next monthly meeting of the Committee.

Appointment Vacant.—Engineering representative for power business, for the Sales Department of the Bristol Corporation (£160). See our advertisement pages in this issue.

Fatalities.—Newcastle-on-Tyne.—An inquiry was opened on 3rd inst. at Newcastle Royal Infirmary, before Deputy-Coroner R. E. B. Lisle, into the circumstances attending the death of Frederick Dennis Hasdell, 32, an electrician, employed by the Newcastle-on-Tyne Electric Supply Co., who lodged at Whickham, and died on 2nd inst. Mr. Hasdell was in charge of the Newcastle Co.'s sub-station at Blaydon Haughs, and it is understood that he and a man named Robert Winde were engaged in testing the low-tension switchboard, when suddenly there was what was described as "an explosion." The place was filled with smoke, and Mr. Hasdell and Winde were both burned. The former, indeed, rushed out with his clothes on fire. Help was speedily obtained, and the injured men were attended by Dr. McAleenan. Mr. Hasdell was found to have received extensive burns about the face and body, and he was conveyed by Dr. McAleenan and a constable to Newcastle Infirmary in a motor-car, but he died within a few hours. Winde was burned about the arms and hands. Owing to the accident, some of the local works were temporarily stopped. At the inquiry the Deputy-Coroner said that the only witness who could give evidence as to the accident was at present injured himself, and it would be some time before he would be sufficiently recovered to attend—probably three weeks before the man got the bandages off—so he proposed to adjourn the inquiry for six weeks, to June 18th.

Tullamore.—An inquest was held on April 30th, into the death of Laurence Carroll, employed by Mr. Norman Robinson, Dublin, in putting up electric lighting wires at Dew Park residence, Tullamore. Deceased fell from the top of a telephone pole.

Jarrow.—On May 1st, an inquest was held concerning the death of a labourer, Thomas Tinley, 46. According to the evidence, he was assisting to lay an electric cable across some posts and three chimneys at Palmer's rolling mills, when he fell 34 ft. from the top of a pole and was killed. George Sanderson, electrician, said that he thought Tinley's feet slipped while he was lifting the cable into position. It was impossible for him to get a shock. George Furlong, a labourer, stated that if deceased lifted the cable over the insulator it would go over the arm and drag him over if he retained his hold. The pole was 14 in. out of line, and in such circumstances they generally used a piece of rope to prevent the cable going over the arm. Deceased did not use the rope. A verdict of "Accidental death" was returned.

London.—An inquest was held on 2nd inst. into the death of Edward J. Peake, 31, a painter employed by a firm of contractors, who was killed by coming into contact with a live wire on the L.B. & S.C. Railway, at Queen's Road Station, Camberwell. He was on a plank, a few feet above the overhead wire, painting a signal bridge. The foreman denied that he told the men to paint the bridge in the afternoon; he meant them to paint the signal posts, and not the bridge, as that should have been dealt with when the current was off. The medical evidence showed that the man's left leg was partly charred, and that the current had entered there. Death was due to shock following the burns; both arms were burnt. He was surprised that the man had not been killed outright with a 6,500-volt shock. Peake died the day after the accident. The jury, in returning a verdict of "Accidental death," added a rider that there had been negligence on the part of the man's employers in not supervising the work in a proper manner. The deceased left a widow and six children, all under 7 years of age.

Football.—The Bertram Thomas Employés' Football Club has just finished a very successful season, and has had a most auspicious wind-up by an extraordinary run of successes in "The Ecclesboro' Workshop Competition." Over 60 workshop teams entered this competition, including the following engineers and electrical engineers. Messrs. Bertram Thomas's employés met the following teams, which they succeeded in defeating as shown:—

1st Round.	Schemp's Employés	Won	1-0
2nd "	Elkanah Armitage Employés	Drawn	0-0
2nd " replayed	" "	Won	1-0
3rd "	British Westinghouse C.E. Dept.	"	1-0
4th "	Mandleburgs Rubber Works	"	1-0
Semi-Final	Nasmyth Wilsons' Employés	"	1-0
Final	S. Kershaw & Sons "	Drawn	0-0

The final tie took place on Wednesday evening, the 30th ult., and, we are informed, was an extraordinary match in all respects. The result, after full time was played, being a draw with no score, an extra 15 minutes was played, with the same result, then a further extra 10 minutes was played, with still the same result; and a further five minutes was played without any score taking place. Darkness had then set in, so that it was impossible to play any longer, and as this was the last day of the football season it is impossible for the match to be replayed; so the two clubs have agreed to be joint holders of the cup for the next four months, and to play off for the right of holding the cup and taking the first medals in September next.

A special word of praise is due to the players of Messrs. Bertram Thomas's E.F.C. for their long-sustained effort throughout competition, and for their most excellent defence in keeping all opponents out throughout the seven matches which they played, particularly when it is mentioned that they knocked out the last year's holders, Messrs. Nasmyth Wilsons, and the Westinghouse team, who are also past holders of the trophy. The committee and secretary of the above club have worked untiringly during the season.

The St. Helens Cable and Rubber Co.'s Rugby football team won the Warrington workshops' challenge cup on Saturday last. The opposing side in the final round was Pearson & Knowles Ironworks, but we are credibly informed that as the St. Helens backs "were principally from the C.T.S. cable department, they were well able to withstand the mettlesome onslaught of their opponents." Thirty clubs competed, and the odds were 3 to 1 against St. Helens in both the semi and the final ties. The event was celebrated by a dinner and a music-hall show for the victorious team, who also won gold watches presented by the Warrington Football Club.

Imperial College of Science and Technology.—The fifth annual report of the Imperial College for the year ended August 31st, 1912, was issued recently. The total number of students under instruction during the year was 928, as compared with 887 in the previous year. Of this number 779 were full-time and 149 part-time students.

The Wireless Telegraph Report.—A correspondent writes as follows:—The report called for by the Postmaster-General on the merits of long-distance wireless telegraphy has been presented to Parliament by the Committee. There is no cause to question the ability of those appointed to consider this subject from a technical point of view, but the report perhaps would have been more useful if a telegraph man—and there exist such as know telegraphy in all its branches, commercially and technically—had formed part of the Committee, and clause 17 of the report, given here, might then have contained more commercial details:—"Clause 17. The Marconi Co. is, we are satisfied, working on a commercial scale between Clifden and Glace Bay, a distance of about 2,300 miles, though at present the number of messages transmitted either way is not so great as to require duplex working or high-speed transmission. We were, however, present when messages were transmitted automatically at the rate of 60 words (of five letters) a minute, and we see no reason why this rate should not be considerably increased if it becomes necessary. The communication is practically continuous, though there are no doubt, periods when the signals become very weak, and even occasional periods when no signals can get through. Periods of this nature are due to natural conditions, and will be incident to the working of any system. During such periods communication can, in our opinion, be ensured only by the use of great power in the aerial. We understand that for this reason, and having regard to the increased power required for high-speed transmission, the Marconi Co. proposed to employ for the Imperial stations practically double the power now used at Clifden. Even so, we think there may be periods when communication is impracticable, especially in tropical regions where atmospheric disturbances may be expected to cause more difficulty than over the Atlantic."

It does not seem quite plain what is meant by "working on a commercial scale," and we think, says the writer, that when the cost of wireless installations is separated from the manufacture

the expenditure on maintenance and working and capital charges is placed against the receipts, it will be found there is a considerable deficit in many, if not nearly all, wireless installations, and therefore, what we require set out, if we are to understand the actual facts, as to working on a "commercial scale," is the above information in plain figures and not general terms.

With regard to the communication being "practically continuous." To enable this to be understood in anything less than the general terms used, there would, we think, have to be a trial extending over a whole year and during the various seasons, and a daily record would have to be made.

It is well known that any speed can be sent, and, at times, received, but this is not telegraphy.

Lightning Storm.—Considerable damage was done last week by a violent storm which raged in various parts of the country. At Hull a man was blinded by a flash of lightning. Telephone services were disorganised, and buildings seriously damaged, by lightning, but the accompanying floods caused by the deluge of rain gave rise to the worst consequences.

Victorian Railway Electrification.—The *Australian Mining Standard* gives the following latest information regarding the above scheme, and the contracts in connection therewith :—

"The following contracts have been let by the Victorian Government for the manufacture and supply of plant and rolling stock in connection with the intended electrification of the suburban railways :—(*a*) Steel work for power station buildings and sheeting of roof, also complete equipment for one boiler house, Messrs. Babcock & Wilcox, £258,220 ; (*b*) turbo-alternators and transformers, four 10,000-KW. sets, Messrs. C. A. Parsons & Co., £122,235 ; (*c*) sub-station equipment—this is a schedule of rates contract, and the Commissioners undertake to order from contractors, Siemens Dynamo Works, Ltd., within one year, plant to the extent of 60,000 KW., at an estimated cost of £168,000 ; (*d*) electrical equipment for cars, 400 each for motor and trailer coaches, the General Electric Co., of New York, £678,180. The Commissioners also hold options, operative for two years, under these contracts, for the second boiler house, two additional generating sets, 15,000 KW. of sub-station plant, and car equipment for 100 motor and 50 trailer coaches, which form the balance of the scheme as provided for in the report submitted by Mr. Merz. As it is imperative that foundations, conduits, &c., shall be ready before the end of this year, Mr. Merz is pushing on with the preparation of plans, and he has informed the Railway Commissioners that he hopes to be able to despatch them during May. After that, the plans for other branches of the work will be pushed on with, and further details are now being prepared by the departmental officers to enable Mr. Merz to carry the work through as expeditiously as possible. It is expected that the power station will be practically complete by the end of next year ; and that the first line to be converted, that between Sandringham and Broadmeadows, will be electrically operated by May or June, 1915."

Institution and Lecture Notes.—Association of Mining Electrical Engineers (West of Scotland Branch).—At a joint general meeting of this branch and the Scottish Branch of the National Association of Colliery Managers in Glasgow on Saturday last, Mr. W. H. Telfer, general manager of Neilsons and Clyde Coal Co., read a paper on "Power Transmission in Mines." Mr. Telfer considered that fairly large collieries or groups of collieries requiring generating plant of 400 KW. and upwards, ought to have their own plant.

Royal Institution.—In a lecture on "Polarised Light" recently, Dr. T. M. Lowry pointed out the exceptional merits of the mercury arc as the source of light in optical investigations, the pure yellow, green, and violet rays being particularly prominent in its spectrum.

Iron and Steel Institute.—At the annual general meeting of the Institute last week, the Council reported that 108 new members were elected during the year 1912, and that the total membership at the end of the year was 2,119. The total receipts for the year were £6,483, and the expenditure £5,793, leaving a balance of £690. The invested funds of the Institute amounted to £13,213. The Carnegie Gold Medal was awarded to Dr. J. Newton Friend, Worcester, for his research work on the corrosion of iron and steel. A Carnegie scholarship award of £100 was made to Mr. W. H. Patterson (Birkenhead), to enable him to continue his investigations on the constitution and combustion of fuels. The Bessemer Medal was awarded to Mr. Adolphe Greiner, general director of the steel works of Messrs. John Cockerill, Seraing, Belgium, who was responsible for the introduction into Belgian iron and steel practice of the basic processes, and had been to the front in the utilisation of blast furnace and coke oven gas.

The annual dinner of the Institute was held on Thursday evening at the Hotel Cecil, Mr. Arthur Cooper, president, occupying the chair. About 450 persons were present.

Society of Engineers (Incorporated).—At a meeting of the Society on May 5th, a paper on "Tidal Waters as a Source of Power" was read by Mr. C. A. Battiscombe, the object of the paper being to draw attention generally to the commercial possibilities of hydro-electric installations in the British Isles, more particularly with regard to the use of the tides. The author points out that the head of water available for actuating turbines cannot exceed one-third of the range of minimum tides. The form of installation required for a continuous output of power is then discussed. An outline is given of the arrangements proposed for the constant maintenance of a working head, by means of a chamber for the turbines, connected by valves to the tidal way and to three reservoirs in which the tidal water may be impounded, with a description of the proposal of sequence of flow between the tidal way and the reservoirs. It is claimed that the utilisation of the tides for power purposes presents few engineering difficulties as far as principles are concerned, but that the real difficulty lies in the question of cost, and therefore in the choice of the site and in the design of the structural details. It is submitted that not only can the tides be utilised as a constant source of power, but that, taken in conjunction with the power that could be derived from fresh-water rivers, their utilisation would be a great gain to the commercial and industrial interests of the United Kingdom.

The Society held a Bohemian Concert at the Holborn Restaurant on May 3rd, when a varied musical programme, arranged by Mr. Charles Capper, was listened to with much pleasure by the large audience of members of the Society and their friends.

Institute of Metals.—The annual autumn meeting of the Institute of Metals will this year take place in connection with the Ghent International Exhibition, the dates fixed being August 28th, 29th and 30th. Among many important papers to be communicated will be the report of the Corrosion Committee. Gentlemen desirous of attending the Ghent meeting should send in their forms of application for membership to the Secretary of the Institute, Caxton House, Westminster, S.W., not later than July 31st.

Institution of Civil Engineers.—At the annual general meeting, held on April 29th, the result of the ballot for the election of officers was declared as follows : President, Mr. Anthony George Lyster, M.Eng. (London) ; Vice-Presidents, Mr. B. H. Blyth, M.A. (Edinburgh) ; Mr. J. Strain (Glasgow) ; Mr. G. R. Jebb (Birmingham) ; Mr. A. Ross (London). Amongst the other Members of Council are Mr. J. A. F. Aspinall, M.Eng. ; Col. R. E. B. Crompton, C.B. ; Mr. Basil Mott (London) ; Mr. Dugald Clerk, F.R.S. ; and Mr. Edward Hopkinson, M.A., D.Sc.

Institution of Civil Engineers (Students).—The thirty-eighth annual dinner took place at the Trocadero Restaurant on Wednesday, last week, Mr. R. Elliott-Cooper (President of the Institution of Civil Engineers) presiding.

Institution of Electrical Engineers.—The following are the names of the authors, and titles, of the papers which will be discussed at the joint meeting to be held in Paris, with the Société Internationale des Electriciens, from May 21st to 24th :—"High-Tension Continuous-Current Traction," by M. Gratzmuller ; "Single-Phase Traction," by M. Latour ; "The Electrification Schemes of the Chemin de Fer du Midi," by M. Julian ; "The Electrification of the Paris Suburban Lines of the State Railway," by A. N. Mazen ; "Railway Electrification Problems in the United States," by H. Parodi ; "Petrol-Electric Motor-Trains," by J. B. Damoiseau ; "Long-Distance Transmission of Electric Energy (Continuous-Current)," by J. S. Highfield ; "Long-Distance Transmission of Electric Energy (Three-Phase Current)," by H. Leblanc ; "Automatic Telephony : Application of Mechanical Devices to the Assistance of Manual Operating in Telephone Exchanges," by W. Slingo.

I.E.E.—Manchester Section.—The report of the Committee shows that the number of members at the close of the session was 812, an increase of 27 over the figures of last year. For the session 1913-14, the chairman will be Prof. E. W. Marchant ; vice-chairmen, Dr. E. Rosenberg and Mr. P. P. Wheelwright ; ordinary members of Committee, Messrs. C. C. Atchison, C. J. Beaver, K. M. Faye-Hansen, H. J. Hawkins, E. L. Hill, E. M. Hollingsworth, G. Layton, A. E. KcKenzie, B. Thomas, Prof. Miles Walker, B. Welbourn, F. H. Whysall ; past chairmen, Messrs. J. S. Peck, Wm. Cramp, and A. A. Day ; hon. secretary and treasurer, Mr. Julius Frith, The Homestead, Victoria Park, Manchester ; assistant secretary and treasurer, Mr. A. L. Green, 8, Westminster Avenue, Manley Park, Manchester. The report of the Students' Section, which numbers 197 members, shows an average attendance at meetings of 42. Mr. H. A. Carney is vice-chairman, and Mr. A. T. Robertson hon. secretary.

Royal Institution.—The annual meeting was held on May 1st, Sir James Crichton-Browne, treasurer and vice-president, in the chair. The annual report of the Committee of Visitors for the year 1912, testified to the continued prosperity and efficient management of the Institution. Thirty-nine new members were elected in 1912. The Duke of Northumberland is president for the ensuing year ; secretary, Mr. Alexander Siemens ; and the managers include Sir William Crookes and Mr. A. A. Campbell Swinton. Among the visitors are Mr. Dugald Clerk, Mr. R. Kaye Gray, Mr. H. R. Kempe, Mr. C. E. S. Phillips, and Dr. W. N. Shaw.

Wages During Sickness.—A vigorous conflict is proceeding between the Leeds and Bradford Chambers of Trade and the National Shop Assistants' Union in regard to the Chambers' proposal that assistants shall sign a printed agreement relieving the employer of the newly discovered Common Law liability to pay full wages during absence through sickness. Negotiations have been fruitless. The Chambers insist on maintaining their position and the Shop Assistants' Union have sent special agents into these districts to persuade assistants to join the Union. These agents are addressing public meetings on the question wherever they can get the opportunity, and are threatening to compile and publish a black list of tradesmen who insist on the signing of the agreement.

London Chamber of Commerce.—The annual meeting of the Chamber was held on April 24th. The annual report, in dealing with the Electrical Trades Section, states that at the first meeting of this Section attention was given to the important municipal trading test of "The Sheffield Corporation *versus* Davidson," in which an injunction was obtained restraining the Sheffield Corporation from carrying on the business of supplying electric light fittings and electric bells in competition with other contractors in the city. The Sheffield Corporation afterwards

sought Parliamentary powers to carry on the business of making electric fittings and wiring premises. The Section approved of the objections of the Electrical Contractors' Association to this interference with legitimate private enterprise, and supported the opposition in Parliament. A circular letter was issued to interested members asking for financial support to the Parliamentary opposition, and a sum of 50 guineas was obtained, partly from the funds of the Municipal Trading Committee and partly from other subscribers.

Dealing with the International Congress on the application of electricity held at Turin in 1911, the report states that Mr. Leon Gaster, who had been appointed as the Section's representative, reported fully as to the proceedings, and that a resolution had been adopted urging the appointment of an International Commission to consider all methods of lighting and technical problems connected therewith.

The Section endorsed the action taken by the Institution of Electrical Engineers, in opposition to the proposed removal of certain exemptions granted to the electrical industry under Sections 54, 55 and 56 of the Factory and Workshop Act, 1911, on the grounds that such exemptions were necessary owing to the circumstances of the employment and the requirements of the public, and authorised the chairman to take all necessary steps in support of the Section's views. The views of the industry were, to some extent, covered in the report of the Committee which, though recommending the withdrawal of the exemption, suggested that the case of electrical stations might be met by a special provision allowing the employment of boys of 16 years between 6 a.m. and 12 midnight for a specified period. Other matters mentioned in the report were the Second Census of Production and the Light Railways Bill.

Fire Prevention.—The British Fire Prevention Committee's Testing Station, near Regent's Park, which has been recently extended and altered, was reopened on Wednesday, when high-temperature fire tests with fire-resisting glazing (Luxfer electro glazing), and with fire-resisting party wall doors (Chubb's reinforced concrete doors), were carried out.

Birmingham Electric Club.—At a meeting of the Club, on Saturday, two interesting papers were read, one by Mr. Fennel, on "Purchased *versus* Home Generated Power," and the other by Mr. F. W. Foster, on "Direct *versus* Alternating Current for General Works Power."

A Dead-Short Romance.—She was a sweet 17 (S.W.G.), single as yet. In feature ampereious, in form she was flexible. Her dress, taped and braided, was a double cotton-covered overall. Such was the alluring specification of Miss Milly Meter.

He was middle aged—35/40—and, temporarily stranded far from ohm by a volt-face of fortune, had become a conductor. Never a great feeder, a continuous diet of currents had made him more wiry than ever. But still he did his jute-y; he was essentially a V.I.R.—good Latin for a Man.

They met. She tendered a copper (100 per cent. M.S.) for her fare. He, in a state of high tension, dropped it. Both went to earth to recover it. Their heads made contact, and their hands. She responded to his ami-cable pressure, without resistance; was she not his twin soul?

The rest was easy. Over a three-cores lunch compounded of ozokerit and gutta-percha, he proposed; and she, after a show of refuse-al, did the usual coy consent trick. Their lips short-circuited. (That's the bit u men—you sentimental men—were waiting for. Watt!) A short en-gauge-ment, and they were married, spliced, joint in holy matrimony; and lead thereafter a life of bliss. You see 'em, eh?—H. R. T.

The Neon Lamp.—In a paper read before the Société Internationale des Electriciens, an account is given of an experimental research upon the neon lamp with other "luminescent" lamps, and the curious fact is brought out that the candle-power of this lamp cannot be determined. The difficulty arises from the red colour of the neon light, that being a colour for which the sensibility of different observers' eyes varies enormously; the candle-power measurements ranged between values in the ratio of no less than 1 to 3, and there was no particular value round which the observations were grouped. On the other hand, all the observers were agreed on the increase of visual acuity with high intensities of illumination with neon light; and as regards fatigue of the eye, the neon tube was the best of all the light sources tested.

A Large American Sign.—A mammoth electric sign has been erected on the roof of the Majestic Building in Milwaukee, Wis. The sign will consist of the single word "Gimbels," to advertise the department store of that name. The sign is 150 ft. long and 54 ft. high; each letter is 34 ft. high. The total weight is about 16 tons; 10,000 ft. of copper wire were used in wiring the letters. The total candle-power installed is about 32,000, and the cost of operation is estimated at $10,000 annually.—*Elec. World.*

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The Hammersmith Electricity Committee having considered applications for additional increases in salaries from a number of officers in the electricity department, recommends that the maximum of MR. H. R. WATTS, meter assistant, be increased to £175 per annum, to be reached by two annual increments of £12 10s. each; that the maximum of MR. T. A. TAYLOR, mains superintendent, be increased to £175, to be reached by two annual increments of £12 10s. each; that MR. T. H. MEACOCK, wages clerk (Class 5), be promoted to Class 4 at a salary of £100, rising by £5 to £130 per annum; and that no action be taken on the other applications.

The Islington B.C. last Friday appointed MR. W. E. BRADSHAW, of the Charing Cross, West End and City Electric Supply Co., Ltd., to the position of mains superintendent, recently rendered vacant by the resignation of MR. T. A. G. MARGARY.

The Dublin Corporation had before it on Monday a recommendation of the Electric Supply Committee, that the salaries of the City electrical engineer, MR. MARK RUDDLE, be increased from £750 by annual increments of £50 to £1,000; that of MR. L. J. KETTLE, deputy electrical engineer, from £400, by annual increments of £50, to £600; and that of MR. GILBERT ARCHER, chief distribution engineer, from £350, by £25 per annum to a maximum of £450 a year.

It is stated that the appointment that is being taken up by MR. H. H. COUZENS, late of Hampstead, is that of general manager of the Toronto electric system, under the Toronto Electric Commissioners.

MR. J. H. KIRK, shift engineer at the West Bromwich Corporation Electricity Works, is leaving in order to take up a similar position in the Chiswick power station of the London United Tramways. On behalf of the staff at West Bromwich he has been presented with a suitably inscribed silver cigarette case.

MR. W. H. WOODS, on leaving the Weardale power station, was presented by the staff of the Cleveland and Durham Electric Power, Ltd., with a non-magnetic centre second stop watch and a fountain pen. Mrs. Woods was presented with a gold brooch.

MR. T. W. MACKAY, late shift engineer with the Cleveland and Durham Electric Power, Ltd., has been appointed to a staff position with the Hong-Kong Electric Lighting Co.

The Colne T.C. has decided to increase the salary of the electrical engineer, from £300 to £325 per annum.

Tramway Officials.—At a meeting of Southport Tramways Committee on May 1st, MR. B. ANDREWS, formerly manager of Southend Corporation Tramways, and manager to the Malta Tramways Co. for three years, but latterly engaged with a firm of engineers in Otley, was appointed manager of the Southport Tramways at £200 per annum. There were 106 applicants, and Mr. Andrews was chosen from five selected candidates.

MR. EDGAR HARRY COCKSHOTT, formerly chief engineer of the London United Tramways Co., Ltd., has been appointed to the position of assistant engineer to the London Underground Electric Railways Co., Ltd.

General.—MR. E. GARCKE was, on Monday, elected a member of the Royal Institution.

MR. ALFRED W. BEUTTELL has removed to 203, Victoria Street, London, S.W.

MR. GEORGE C. HAMILTON, of Knutsford, a member of the firm of Messrs. Drake & Gorham, has been adopted as the Unionist candidate for the by-election in the Altrincham division, caused by the resignation of Mr. J. R. Kebty-Fletcher, M.P.

MR. ANDREW WILKINSON has just taken up the position of works manager to the Anti-Attrition Metal Co., Ltd., Glengall Works, London, S.E. Mr. Wilkinson for the past five years has been in the service of the London County Council as works superintendent of their tramway repair depôts.

The staff of Messrs. Crompton & Co., Ltd., at the Arc Works, Chelmsford, has presented a cabin trunk, a Gladstone bag, and an inscribed silver cigarette case, to MR. A. DOWSETT, who, after 13 years' service on the staff, is leaving to take up an appointment on an Atlantic liner.

Indian Engineering states that MR. J. H. CARDEW, electrical engineer, Oudh and Rohilkhand Railway, is permanently transferred to the North-Western Railway as electrical engineer of that line. He will have charge of the electrical department of the Oudh and Rohilkhand Railway, in addition to his own duties, until further orders.

The Right HON. LORD CASTLETOWN, of Upper Ossory, K.P., C.M.G., Chancellor of the Royal University of Ireland, has been appointed chairman of the Governors of Faraday House Electrical Training College, in succession to the late Earl of Crawford, K.T., F.R.S.

Wills.—MR. JAMES TANGYE, one of the founders of Tangyes, Ltd., left £13,161.

MR. HENRY DRAKE, chairman of Callender's Cable and Construction Co., and of the Anchor Cable Co., Ltd., left £69,634.

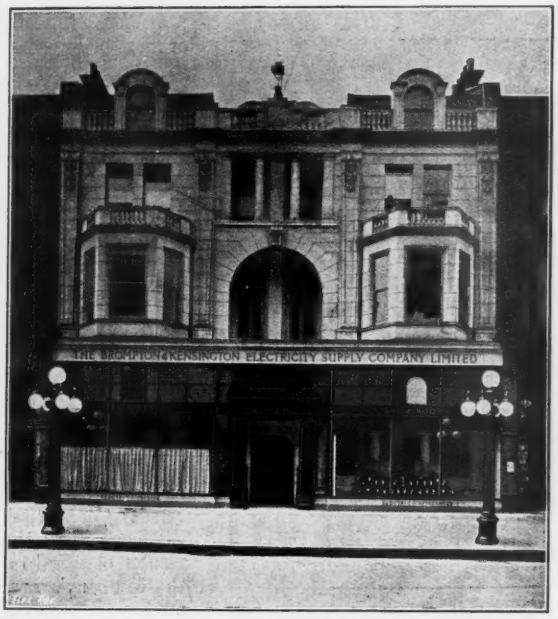
MR. WILLIAM BULLOUGH, of Messrs. Howard & Bullough, Ltd., Accrington, left £187,835 gross, and net personalty £185,652.

MR. GEO. MATTHEY, F.R.S., of Johnson, Matthey & Co., Ltd., left £305,252 gross, and net personalty £301,067.

Obituary.—We tender our deep sympathy to Dr. J. T. Bottomley, LL.D., F.R.S., upon the death of his wife—daughter of the late Chas. R. Blandy, Esq., of Madeira—which occurred on Tuesday last, after a few days' illness.

THE BROMPTON AND KENSINGTON ELECTRIC RESTAURANT.

ONE more proof that electric cooking in this country has at last been roused from its coma, and is henceforth to be regarded as a serious commercial proposition, is to be found



THE BROMPTON AND KENSINGTON CO.'S ELECTRIC RESTAURANT IN EARL'S COURT ROAD, S.W.

in the admirable equipment of the premises in Earl's Court Road (a few doors from the District Railway Station), which the Brompton and Kensington Accessories Co. has, during the past few months, converted into a fine electric restaurant, the main hall of which is illustrated here with the mezzanine or gallery room in the background.

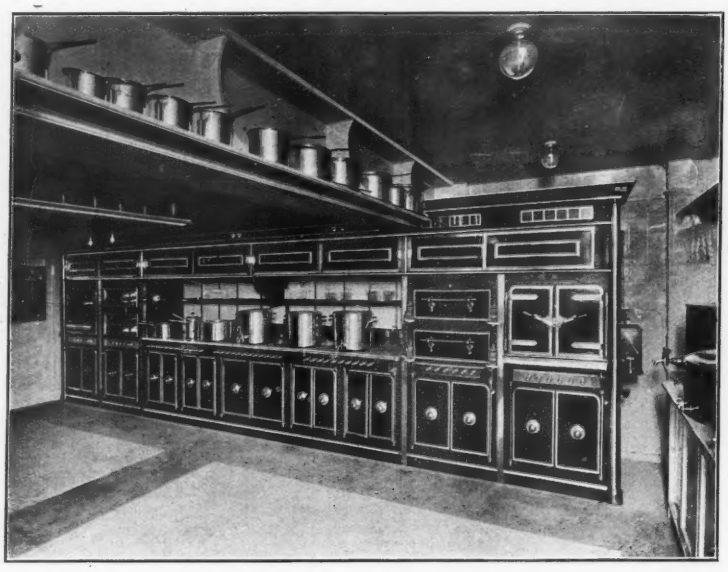
No pains have been spared to make the premises worthy of their high destiny, and the architects, decorators, and furnishers, are to be complimented upon their intimate acquaintance with, and realisation of, the conditions and surroundings best securing the comfort and convenience of tired and hungry humanity. In addition to the main hall and mezzanine, there is provided a snug tea room and a telephone cabinet. Adjacent to the dining hall there is an inquiry office and a sale room, so that those who have consumed food of one description or another —varying from the portly steak to the daintiest of tea cakes—in full sight of some of the gleaming "armour plated" ranges which have cooked their viands, and which are still cooking—as the red signal lamps and nothing else testifies—these persons may at once take the first steps towards becoming "consumers" in the best sense of the word, and realising in their own homes those advantages of which they have lately had tangible proof.

THE MAIN RESTAURANT, SHOWING GRILL AND MEZZANINE.

On April 30th we were guests of the chairman and directors of the company on the occasion of an inaugural banquet comprising nine excellent courses. Every dish was cooked exclusively by electric heat, and by the time these lines are published, the restaurant will be opened to the public, and, the refrigerating plant being completed, "electric ices" will be added to the menu.

Among the guests participating in what was a no less historical than enjoyable ceremony, were Messrs. A. B. Anderson, H. H. Berry, S. Beeton, R. A. Chattock, J. Christie, F. A. Cortez Leigh, J. C. L. Coward, K.C., W. F. Davies, R. S. Downe, J. S. Highfield and A. H. Seabrook. At the conclusion of a meal, during which, to judge from the snatches of conversation which reached us, golden opinions were formed which will lead to very brisk cooking business in the near future, the toast of "The King" was received with enthusiasm, and Mr. Coward rose to propose "Success to the New Enterprise." The speaker recalled those occasions on which he had been compelled by professional engagements to criticise the policies and methods of the company in whose house he now found himself a guest. Under these circumstances, he was pleased to find that his beer had not been poisoned! On one occasion when he had promoted an electric tramway Bill, Lord Ravensworth had stigmatised as preposterous and intolerable the suggestion to have two naked conductors alongside the track. As development had been wide and rapid since those days, so he felt sure it would be henceforth from the epoch marking function at which they were present that night. In replying to this toast, Mr. H. R. Beeton (chairman of the Brompton and Kensington Electricity Supply and Accessories Companies), remarked that 25 years ago he had made so many statements and

prophecies (in connection with the inauguration of the Brompton and Kensington electricity supply), which time had proved incorrect that he proposed to be extremely reticent on this occasion. One of the extraordinary statements to which he had lent his name in the past was that electric lamps gave no heat. Gas had been routed from the lighting field, but was at present entrenched in the field of cooking. During recent years the cost of electrical energy had been reduced 75 per cent., and in the near future electric cooking would far exceed electric lighting in importance as a central station load. The reliability of electrical apparatus had been proved beyond doubt, and the persistent ingenuity of gas-cooker designers had paved the way for rapid developments in electrical apparatus. He regarded the present restaurant undertaking as a sober, serious business proposition, and when the L.C.C. entered into its inheritance he believed that the Brompton and Kensington Accessories Co. would be in a position to continue its business independently, thus ensuring continued prosperity to the shareholders.



Electric Cooking Range.

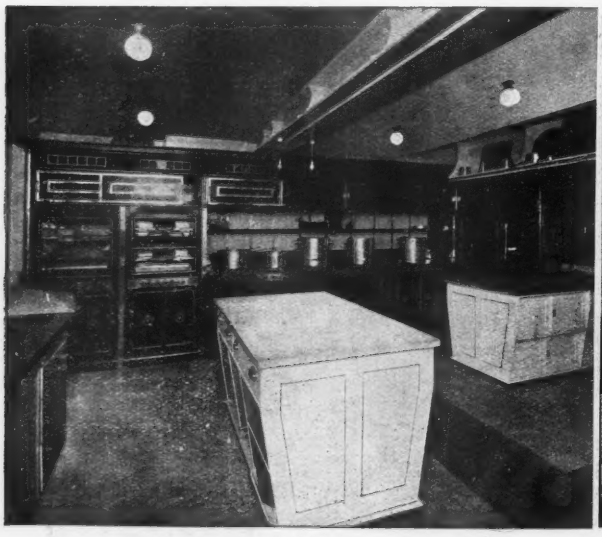
A short but excellent musical programme followed, and the guests were then free to wander where they would from the luxurious public rooms to the gleaming kitchens on the first and ground floors and to the hot water pit, the refrigerator room and the transformer chamber in the basement. The neat black and bright metal work and the spotless paint and woodwork lent to the strictly utilitarian parts of the premises a distinctly naval atmosphere.

The restaurant has a seating capacity of from 90 to 95 persons. The lighting, cooking, bread baking, ventilating, heating of the building, water heating, refrigerating, cleaning, signalling and time service are all accomplished electrically. In the main kitchen, which is part of the restaurant (being situated on the first floor and approached through a plate-glass door), the ordinary visitor will be welcomed at all times, and will thus be able to appreciate the convenience and extreme cleanliness appertaining to an electric service.

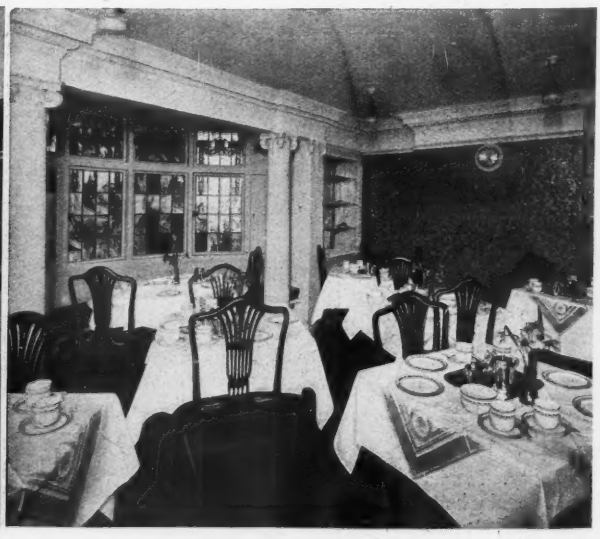
Another feature of the restaurant is a supply of current on every table, and visitors may, if they wish, carry out small cooking operations with toasters, chafing dishes, &c. Each table is provided with one or more bell pushes, by which a signal lamp corresponding with the table is lighted up in the service room, and remains lighted until the particular table is attended to.

The electrical equipment has been supplied by various manufacturers to the design and specification of the Accessories Co., and is based on experience gained at the "Queen's Head" Electric Restaurant, Earl's Court, last summer, and the results obtained on the company's own and consumers' premises during the past three years, which have enabled them to produce apparatus which is suitable for the purpose in view, and able to stand up to its work under everyday conditions.

In the main kitchen is provided one large cooking suite having a loading of 70 kw., controlled by 58 switches; there are nine ovens in the lower part, of various sizes and loadings for different cooking operations. At the extreme right, there are two steamers for vegetables, fish, puddings, &c., and immediately adjoining, ovens for baking all varieties of bread and rolls required in the restaurant. At the left hand side there is a large fish fryer, adjoining which is a grill and toaster. On the main hob are fitted 12 boiling plates of various sizes and loadings. Running along the top of the suite are switch indicator lamps, and immediately underneath are hot cupboards for silver.



The Electric Kitchen.

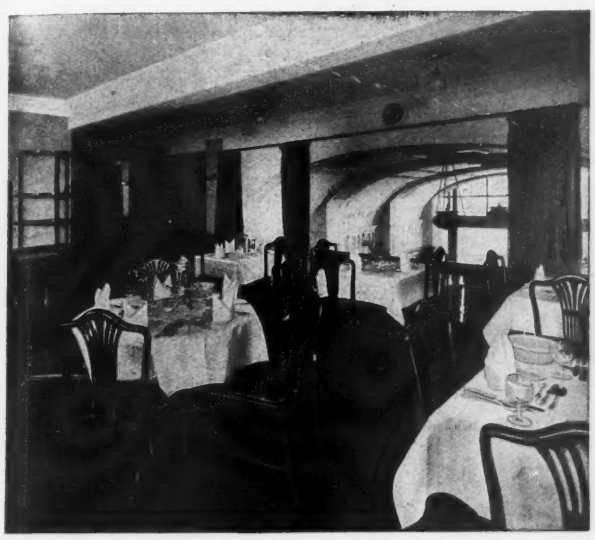


The Tea Room.

The Brompton and Kensington Co.'s Electric Restaurant.

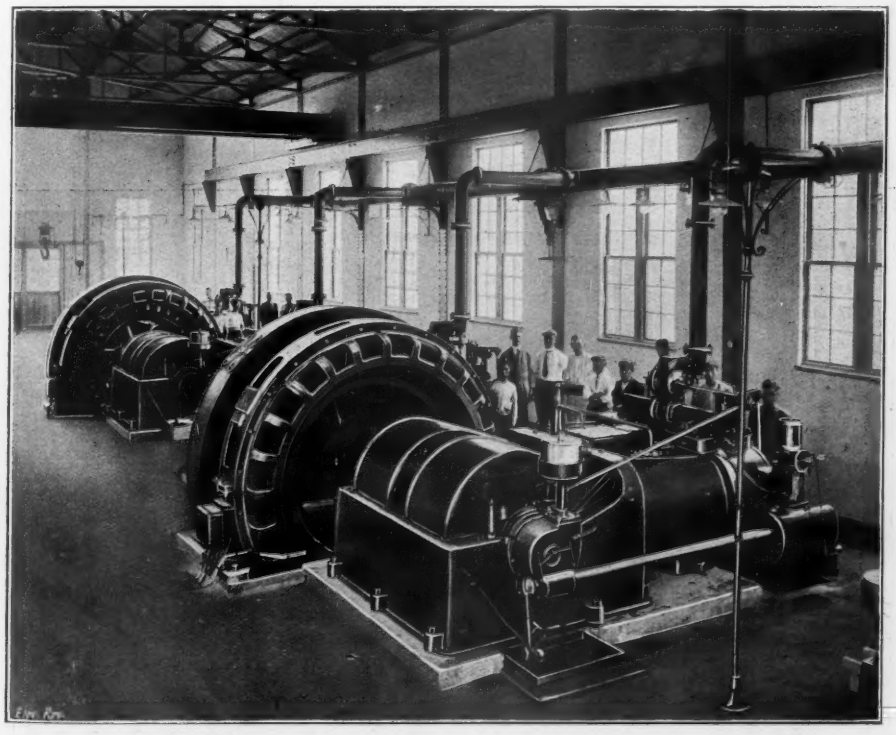
The other equipment in the main kitchen comprises an electrically-heated coffee roaster, electrically-driven meat chopper and coffee grinder, bain marie, fish kettle, stock pot, egg boilers, &c.

The hot water in the kitchen and scullery on this floor is supplied by a "Cooper" water heater.



THE MEZZANINE, B. AND K. ELECTRIC RESTAURANT.

In the main restaurant is fitted a large double griller, together with a carving table and hot cupboards, and hot plates are fitted throughout the establishment, so that hot dishes may be served hot, and not warm.



VIEW IN THE GENERATING STATION, FUSAN ELECTRICITY WORKS, SHOWING ALTERNATORS (see page 772).

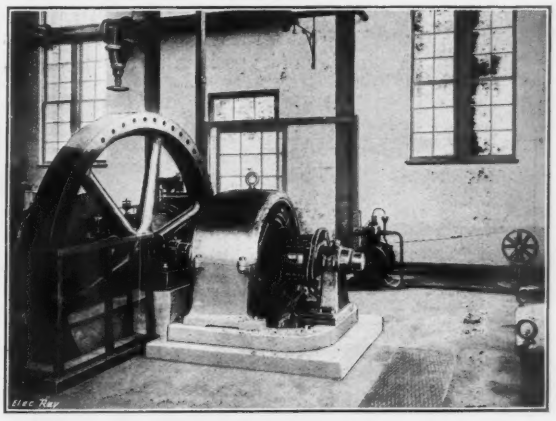
In the servery at the back of the main restaurant are the electrically-heated urns for the purpose of supplying tea, coffee, &c.

The loading of the whole electrical equipment is approximately 140 KW., and this is supplied from two sub-stations on the premises, each containing two 50-KW. transformers, which also feed into the adjoining network.

One of the basements is fitted as a messroom, where the restaurant staff, numbering about 18, will have their meals served and cooked. The installation here will be shown under ordinary working conditions to visitors. There is also on the first floor a small model kitchen fitted with the usual pattern of domestic stove.

Another basement contains refrigerating plant for supplying the cold chamber and making ice, and a 100-gallon "Cooper" heater supplying hot water for general purposes.

The ventilating arrangements comprise duct-work by means of which the air is drawn in from outside—cooled in



25-KW. EXCITER SET, FUSAN ELECTRICITY WORKS (see page 772)

summer and warmed in winter—and delivered to the restaurant through gratings, being afterwards exhausted by means of fans situated on the roof of the building.

The arrangements for metering all the circuits through the building are very complete and will enable accurate data to be obtained.

The illumination of the various apartments has been carefully studied, and in addition to the ordinary pendants and table lighting, some concealed lighting has been introduced. The company has, moreover, imported from New York a couple of typical "White Way" lamp columns, each carrying five globes, for exterior pavement illumination, as shown in one of our views.

With a view to carrying out its restaurant scheme, the company's premises in Earl's Court Road have been quadrupled in size.

The adjacent basements have also been acquired, and recently the company purchased the premises of the Earl's Court Motor Garage Co., which adjoin and run parallel at the back, comprising over 5,000 sq. ft. superficial area.

These premises will be used as a depôt and workshops for the cooking and heating business in the company's area, for development work generally, and the charging of electric vehicles.

In conclusion, we are indebted to Mr. R. S. Downe, the

company's general manager, for his courtesy in giving us the fullest information; we may add that his own and his company's extensive knowledge of electrical cooking requirements is at the fullest disposal of any who may be interested in the matter.

NEW ELECTRICITY WORKS AT FUSAN, KOREA.

By J. DOUGLAS COLLIER.

The port of Fusan, situated at the S.E. corner of Korea, is becoming important in view of its position relative to Japan, and recently has become the terminus of the alternative route between Japan and Europe by the Trans-Siberian Railway, the other route being *viâ* Vladivostok. The population numbers about 55,000, of whom 25,000 are Japanese and the remainder Koreans.

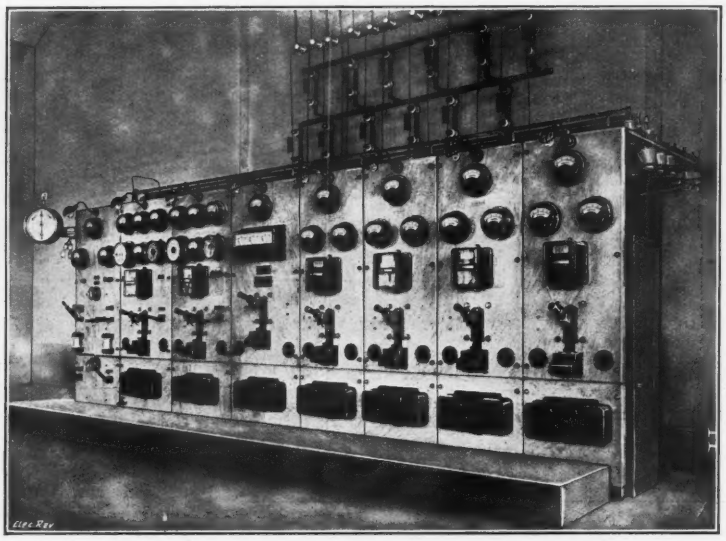
The original electric lighting plant was installed about ten years ago; it consisted of four direct-current generators belt-driven from steam engines, having a total capacity of 180 kw., all of American make.

Following the annexation of Korea by Japan in August, 1910, a Japanese company, known as the Kankoku Gas and Electric Co., was formed to buy out the old electric light company. This company has recently installed a combined gas and electricity plant with entirely new machinery, and a description of the latter may be of interest, as the new generators are gas-engine driven for parallel operation.

The two main sets have a capacity of 300 kw. each, at 3,500 volts, three-phase, 50 cycles, speed 188 r.p.m., and consist of four-cylinder premier gas engines with direct-coupled Bruce Peebles alternators, the rotors of which are directly mounted on the engine fly-wheels placed between the cylinders, which are in pairs. The cranks are arranged to obtain an impulse every half revolution.

Starting is effected by compressed air, working on two cylinders, and a compressor, belt driven from a 2-b.h.p. vertical gas engine, has been installed for this purpose.

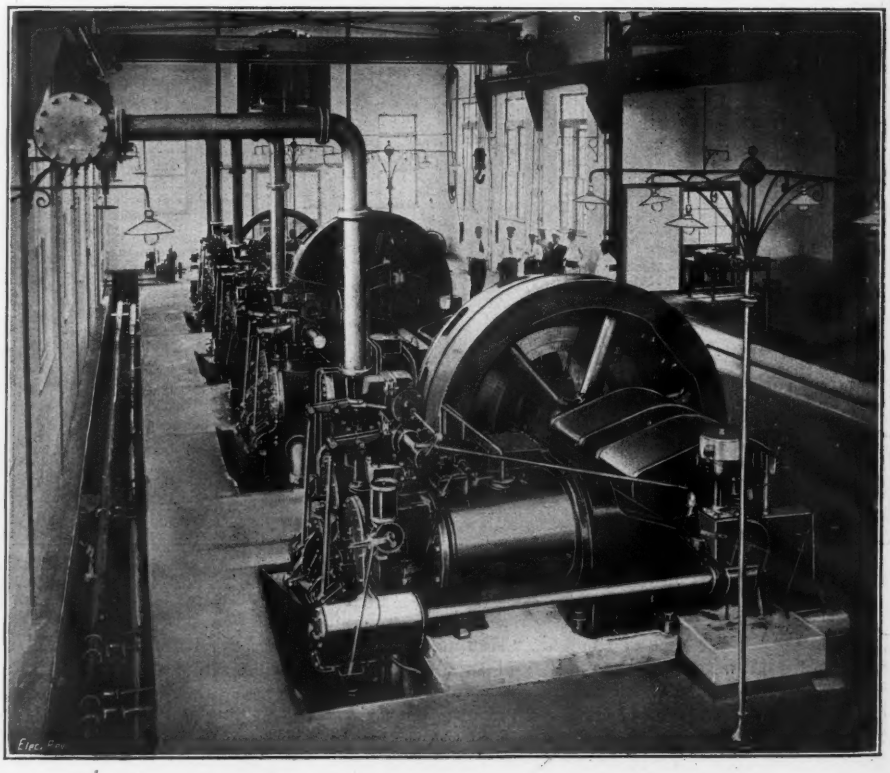
There are two separately driven exciters, one of 25-kw. capacity coupled direct to a single-cylinder gas engine running at 220 r.p.m., and the other, a motor-generator, having an output of 23 kw., driven by a three-phase, 3,500-volt, 50-cycle, 750 r.p.m. squirrel-cage induction motor, supplied from the main sets. The exciters are flat compound wound for 125 volts; the capacity of either machine is sufficient to excite three 300-kw. units, allowance being made for the installation of an additional set in the future.



The Main Switchboard, Fusan Electricity Works.

The switchboard, which has been manufactured by Messrs. Ferranti, Ltd., is of white Silician marble, and comprises two generator panels, one exciter panel and one a.c. motor panel, also four three-phase feeder panels.

In addition to the usual instruments, each a.c. panel is fitted with a Ferranti three-phase adjustable overload time-limit relay to work the tripping gear of the oil switches, which are operated from the exciter circuit. All the h.t. switches are fitted with red and green signal lights; the synchronising gear is of the usual synchroscope type; a three-phase static-type ground detector with water resistance cut-outs is installed in accordance with official regula-



Four-Cylinder Gas Engines, Fusan Electricity Works.

tions. Spark-gap type lightning arresters, with choking coils, are provided for each feeder, all these being mounted on a separate framework on the wall at the back of the switchboard.

The engine circulating water is supplied by a two Peebles-Gwynne centrifugal pumps driven from the exciters.

As regards crane equipment, the engine room is provided with a 10-ton hand-operated crane by Messrs. Higginbottom and Mannock.

The distribution is carried out by means of overhead lines with weather-proof covering, carried on wooden poles. Single-phase oil-cooled pole-type transformers are used, having a ratio of 3,500/110 volts, the latter being the usual voltage of supply for lighting and small motors in this part of the world.

For the present, the engines are being run on gas having a calorific value of about 600 B.TH.U. net per cubic foot, supplied from the town's gas plant; but as the ordinary lighting and heating load on the latter increases, it is intended to install a producer gas plant for the engines at a later date, and provision as regards piping and valves has been made accordingly.

The machines described operate in parallel successfully, and the load may be regulated on either generator to a nicety.

The plant has been supplied and installed by the contractors, Messrs. L. J. Healing & Co., London and Yokohama, in accordance with the specification of Mr. I. Naito, engineer, Tokyo Gas Co., who has acted as consulting engineer to the Kankoku Gas and Electric Co.

NEW COMPANIES REGISTERED.

Thompson Bros. (Blackburn), Ltd. (128,198).—This company was registered on April 7th, with a capital of £3,000 in £1 shares, to take over the business of motor and electrical engineers, motor-car dealers and agents, &c., carried on by Walter and William Thompson as "Thompson Bros." at Preston New Road, Blackburn. The subscribers (with one share each) are:—Walter Thompson, Norwood, Somerset Avenue, Wiltshire, electrical and motor engineer; Wm. Thompson, 50, Carnarvon Road, Blackburn, motor engineer. Private company. The number of directors is not to be less than two or more than five; the first are Walter Thompson and Wm. Thompson; qualification, £100. Solicitor, J. Taylor, 41, Ainsworth Street, Blackburn. Registered office, 15, Preston New Road, Blackburn.

Simms Motor Units, Ltd. (128,437).—This company was registered on April 18th, with a capital of £20,000 in £1 shares, to carry on the business of manufacturers and proprietors of and dealers in magnetos, magneto parts and accessories, motors, motor and other carriages, boats, flying machines, cycles, &c., and to adopt an agreement with F. R. Simms. The subscribers (with one share each) are:—H. Dock, 14, Regent Street, S.W., clerk; J. A. Maynard, 14, Regent Street, S.W., clerk; A. Cleave, 59, Cambridge Road, Anerley, S.E., clerk; J. H. Jones, 37, St. Stevens Terrace, South Lambeth, S.W., clerk; H. G. Hancock, 28, Olive Street, Romford, clerk; R. Pudgen, 96, Mildenhall Road, Clapton, N.E., clerk; E. Percy, 14, Regent Street, S.W., clerk. Minimum cash subscription 25 per cent. of the shares offered to the public. The number of directors is not to be less than two or more than five; the first are F. R. Simms, W. M. Rolph, and R. Scruby; remuneration, £50 each per annum and a percentage of the profits. Registered by John S. and F. Purchase, 14, Regent Street, S.W.

Models, Ltd. (128,331).—This company was registered on April 14th, with a capital of £10,000 in 400 preference shares of £5 each, and 8,000 ordinary shares of £1 each, to carry on the business of manufacturers of mechanical and constructional models, including locomotives, railways, steam and small internal combustion engines, aeroplanes, &c., and to adopt an agreement with the Models Development Syndicate, Ltd. The subscribers (with one share each) are:—A. F. Brough, 66, Mildred Avenue, Watford, draughtsman; J. Crussell, 60, Leavesden Road, Watford, apprentice; W. Cox, 85, Fleet Street, E.C., printers' manager; R. Reis, 169, Fordwych Road, Cricklewood, secretary; R. M. Sutcliff, "Escendene," Cavendish Road, Sutton, Surrey, traveller; Evelyne B. Evans, 57, Bartholomew Road, Camden Road, N.W., clerk; H. E. Ryman, 49, Springfield Road, Walthamstow, mechanic. Minimum cash subscription, £1 000. The number of directors is not to be less than three or more than nine; the first are K. Cochrane-Holroyd, A. W. Bond and F. Tibbey; qualification (except first directors), £150; remuneration (except managing director), not less than £25 or more than £75 each per annum. Registered by R. Reis, 169, Fordwych Road, Cricklewood, N.W.

Lodge Fume Deposit Co., Ltd. (128,743).—This company was registered on May 2nd, with a capital of £9,000 in £1 shares, to carry on the business of manufacturers of and dealers in certain appliances used in connection with an invention for the production of continuous high potential electrical discharges applicable for the deposition of dust, fume, smoke, fog and mist and for other purposes, with the exception of such purposes as those for which the Agricultural Electric Discharge Co., Ltd., is licensed. The subscribers (with one share each) are:—F. H. Bretherton, Belgrave House, Gloucester, solicitor; G. Newman, Sutton House, Howard Street, Gloucester, corn merchant; W. F. Newman, 85, Park End Road, Gloucester, traveller. Private company. The number of directors is not to be less than two or more than seven; the first are Lionel Lodge and Noel Lodge, both of Mariemont, Birmingham, and W. F. Newman, 85, Park End Road, Gloucester; qualification 500 shares; remuneration as fixed by the company; solicitors, Champney, Fream & Corke, Gloucester. Registered by Jordan & Sons, Ltd., 116-7, Chancery Lane, W.C.

Reflecting Glass Letter Co., Ltd. (128,751).—This company was registered on May 2nd, with a capital of £5,000 in £1 shares, to carry on the business of glass workers, sign manufacturers, electricians, &c., and to adopt an agreement with A. Stubbs and C. Persson. The subscribers (with one share each) are:—M. Selby, 46, Tudor Road, Hackney, N.E., clerk; N. C. Meredith, 69, Tasman Road, Clapham, S.W., clerk. Private company. The number of directors is not to be less than two or more than seven; the subscribers are to appoint the first; remuneration, £25 each per annum (£25 extra for chairman). Registered office, 6, Eldon Street, E.C.

Stolz Electrophone Co. (1913), Ltd. (128,419).—Registered April 17th, by Owen, Jones & Co., 88-90, Chancery Lane, W.C. Capital £60,000, in £1 shares. Objects: To carry on the business of manufacturers, repairers and letters on hire of and dealers in electrophones, aids to the deaf, and aural instruments generally, and to adopt an agreement with the Stolz Electrophone Co. (London), Ltd. The signatories (with one share each) are:—A. Hawdon, York Hill, Loughton, Essex, clerk; C. Boyle, 76, Bisson Road, Stratford, clerk; Miss A. G. Jones, South Norwood Hill, S.E.; Miss G. M. Maud, Maythorn, Chaplin Road, Wembley; L. M. Godfrey, 1, Hertford Road, East Finchley, N., clerk; Miss W. R. Mabson, 19, Cumberland Road, Acton, W.; W. J. Ealey, 74, Masbro' Road, West Kensington, W., secretary. Minimum cash subscription, 20,000 ordinary shares. The first directors (to be not less than three or more than seven) are Sir John E. Thrift, Kt. (chairman), 62, Leigham Court Road, Streatham; Lord Rosmead, Wycombe Lodge, Bexhill-on-Sea; F. Clarke, 7, Westbourne Street, Lancaster Gate, W.; and J. Holt, 85, Fleet Street, E.C.; qualification, £100; remuneration, £210 each per annum (chairman, £52 10s. extra). Registered office, 85, Fleet Street, E.C.

Redglo, Ltd. (128,550).—This company was registered on April 24th, with a capital of £4,000 in £1 shares, to acquire from H. S. Martin certain patent rights for improvements in electrical heating and radiating apparatus; also to take over the business of a mechanical and electrical engineer carried on by him at 34a, Great Ancoats Street, Manchester. The subscribers (with one share each) are:—H. S. Martin, 34, Great Ancoats Street, Manchester, electrical engineer; L. S. Taylor, 610, Royal Liver Building, Liverpool, consulting engineer; P. Hutchinson, 610, Royal Liver Building, Liverpool, consulting engineer. Private company. The first directors are H. S. Martin, L. S. Taylor and P. Hutchinson. Solicitor, G. Harley, 1, Water Street, Liverpool. Registered by T. T. Hull & Son, 29, Chancery Lane, W.C.

E. Beckwith & Co., Ltd. (128,509).—This company was registered on April 23rd, with a capital of £500 in £5 shares, to carry on the business of electrical engineers and contractors, founders, mechanical, steam, gas, petrol, motor and sanitary engineers, manufacturers of agricultural implements, &c., and to adopt an agreement with H. E. Beckwith, F. T. Porter and W. H. Sugden. The subscribers (with one share each) are:—H. E. Beckwith, 45, Luton Road, Barking, electrical engineer; F. T. Porter, 158, Ripple Road, Barking, electrical engineer. Private company. The number of directors is not to be less than two or more than five; the first are H. E. Beckwith and F. T. Porter; qualification, £50; remuneration as fixed by the company. Registered office, 3, Chester Terrace, Longbridge Road, Barking.

Preston Portable Battery and Lamp, Ltd. (128,626).—This company was registered on April 28th, with a capital of £2,000 in £1 shares, to adopt an agreement with J. E. Preston for the acquisition of an invention for improvements in galvanic batteries. The subscribers (with one share each) are:—A. C. Warwick, 68, Denman Road, Peckham, S.E., law clerk; W. Sullivan, 43, Dunmow Road South, Leyton, N.E., law clerk. Private company. The number of directors is not to be less than two or more than five; the first are W. E. Morum (chairman), J. E. Preston, H. Vielleville, and A. W. Pask. Registered by H. Dade & Co., 14, Queen Victoria Street, E.C.

New English Glass Manufacturers, Ltd. (128,746).—This company was registered on May 2nd, with a capital of £12,000 in £1 shares, to carry on the business of glass manufacturers and workers, mirror manufacturers, bottle makers, makers of electrical appliances, &c. The subscribers (with one share each) are:—A. F. Prince, 190, High Street, Dudley, licensing officer; S. Pearson, 6, Charles Street, West Bromwich, bottle manufacturer. Private company. The number of directors is not to be less than two or more than six, the first are to be appointed by the subscribers; qualification, £100; remuneration as fixed by the company. Solicitor, J. D. Harward, Stourbridge. Registered by Waterlow Bros. and Layton, Ltd., Birchin Lane, E.C.

Structural Patents, Ltd. (128,754).—This company was registered on May 2nd, with a capital of £10,000 in £1 shares (5,000 pref.), to carry on the business of electric, mechanical, constructional, marine and general engineers, shipbuilders and repairers, founders, &c., to acquire the rights under Patent No. 8,437, of 1904, granted to J. Lilliehook. The subscribers (with one share each) are:—T. E. Samuels, 93, Bramston Road, Harlesden, N.W., clerk; D. Macauley, 3, Lambton House, Fortess Road, N.W., secretary. Private company. Table "A" mainly applies. Registered by Jordan & Sons, Ltd., 116-7, Chancery Lane, W.C.

CORRECTION.—In our issue of April 25th, page 691, the name of a new company was incorrectly given as *Electric Cookers, Ltd.* It should have read *Cylectric* Cookers, Ltd.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

General Electric Tramways Co., Ltd.—A memorandum of satisfaction of debentures, dated June 30th, 1896, securing £15,000, has been filed. Statement under Sec. 12 of 1907 Act, old charges outstanding on July 1st, 1908; now first registered:—4 per cent. first mortage debentures, dated June 30th, 1896, securing £15,000.

Particulars of £15,000 debentures, created February 12th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £11,000. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Fraser & Chalmers, Ltd.—Particulars of £100,000 debentures, created February 6th, and secured by trust deed dated March 14th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £50,000. Property charged: The company's undertaking and property, present and future, including uncalled capital and certain freehold and leasehold lands at Erith. Trustees: Exploration Co., Ltd., 11, Cornhill, E.C.

Egerton & Co., Ltd.—Capital, £2,000 in £1 shares. Return dated February 19th, 1913. 1,511 shares taken up. £1,511 paid. Mortgages and charges: Nil.

Borland, Hagedorn & Co., Ltd.—Particulars of £120 debentures created March 1st, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Reform Lighting Co., Ltd.—Debenture dated March 26th, 1908, to secure £2,750 charged on the company's undertaking and property, present and future, including uncalled capital. Holders: J. T. Zimmermann and Mrs. C. A. Zimmermann, St. Moritz, Villiers Avenue, Surbiton.

Cambridge Electric Tramways Syndicate, Ltd.—Capital, £5,000 in £10 shares; return dated March 6th, 1913, 107 shares taken up; £9 0s. 4½d. per share called up on 90 shares, £10 on 10 shares, and nothing on seven shares, £911 12s. 1d. paid. Mortgages and charges: Nil.

United Sherardizing, Ltd.—Charge created by Receiver, on company's property, present and future (in priority to debentures), dated May 13th, 1913, to secure not more than £150. Holder: W. J. Halsey, 23, Queen Anne's Gate, Westminster, S.W.

Banbury and District Electric Supply Co., Ltd.—Particulars of debentures for an amount not exceeding half the issued capital of the company, created December 2nd, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908; the amount of the present issue being £4,500. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

A memorandum of satisfaction in full on March 26th, 1913, of debentures, dated December 30th, 1910, securing £1,600, has been filed.

City of Buenos Ayres Tramways Co. (1904) Ltd. (82,214).—Capital £1,240,000 in £5 shares. Return dated February 27th, 1913; all shares taken up; £1,240,000 paid. Mortgages and charges: £174,000.

South London Electric Supply Corporation, Ltd.—Issue on April 1st, 1913, of £1,400 debentures, part of a series of which particulars have already been filed.

Paignton Electric Light and Power Co., Ltd.—Issue on April 7th, 1913, of £500 debentures, part of a series of which particulars have already been filed.

Pearson & Cox, Ltd.—Particulars of £750 debentures, created February 11th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £175. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Northampton Electric Light and Power Co., Ltd.—Issue on March 28th of £6,515, and on April 1st, 1913, of £100 debentures, parts of a series of which particulars have already been filed.

Electrical Power Storage Co., Ltd.—Issue on April 10th, 1913, of £5,000 debentures, part of a series of which particulars have already been filed.

Brown & Parsons, Ltd.—Particulars of £1,000 debentures, created March 14th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £625. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

British Mica Co., Ltd. (72,187).—Capital, £5,000 in £1 shares (2,000 pref.) Return dated March 17th, 1913; 2,006 ord. and 629 pref. shares taken up; £1 per share called up on 629 pref.; £629 paid; £2,000 considered as paid on 2,000 ord. shares. Mortgages and charges: Nil.

Bastian Meter Co., Ltd. (53,304).—Capital, £20,235 10s., in 3,000 preference shares of £1, and 68,942 ordinary shares of 5s. each. Return dated March 6th, 1913, 2,011 preference and 39,672 ordinary shares taken up, 5s. per share called up on 4,272 ordinary and £1 on 2,011 preference shares, £3,082 10s. paid, including £3 10s. paid on forfeited shares, £8 850 considered as paid on 35,400 ordinary shares. Mortgages and charges: £2,450.

Bastian & Partners, Ltd. (77,601).—Capital, £2,500 in £1 shares. Return dated December 31st, 1912, all shares taken up, £907 paid, £1,593 considered at paid. Mortgages and charges: £3,325.

Cambridge Electric Supply Co., Ltd. (31,457). — Capital, £100,000 in £10 shares. Return dated March 11th, 1913, 9,423 shares taken up, £9 per share called up, £84,807 paid. A list of allotments (filed March 27th) shows a further 369 shares allotted for cash at £1 premium. Mortgages and charges: £30,000 first debentures, also one debenture, with the Capital and Counties Bank, Ltd., to cover £15,000.

Switchgear & Cowans, Ltd.—Particulars of £3,000 "B" debentures, created December 11th, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908; the amount of the present issue being £250. Property charged: The company's property, present and future, including uncalled capital. No trustees.

Rawlings Bros., Ltd.—Issue on April 11th, 1913, of £1,437 debentures, part of a series of which particulars have already been filed.

Mexican Fuel and Power Co., Ltd.—Issue on April 8th, 1913, of £850 debentures, part of a series of which particulars have already been filed.

I. Frankenburg & Sons, Ltd. (67,889).—Capital, £250,000 in £10 shares (12,500 pref). Return dated February 7th, 1913; 11,323 ord. and 10,010 pref. shares taken up; £10 per share called up on 1,323 ord. and 10 pref.; £18,330 paid; £95,000 considered as paid on 9,500 ord. and £100,000 on 10,000 pref. Mortgages and charges: £15,000.

Key Engineering Co., Ltd. (76,459).—Capital £5,000 in £1 shares (7 defd). Return dated November 7th, 1912 (filed April 10th, 1913; 4,070 ord. and 7 defd. shares taken up; £4,077 paid. Mortgages and charges: £3,500.

Electric Wiring and Fittings Co., Ltd. (29,676).—Capital, £5,000 in £1 shares; return dated February 24th, 1913: 1,382 shares taken up. £1,375 paid, leaving £7 in arrears. Mortgages and charges: Nil.

Hove Electric Lighting Co., Ltd. (36,942).—Capital, £100,000 in £5 shares (5,000 pref.); return dated April 2nd, 1913, all shares taken up; £100,000 paid. Mortgages and charges: £44,600.

Hart Accumulator Co., Ltd. (60,059).—Capital, £110,000 in £1 shares (20,000 pref.). Return dated April 2nd, 1913; 87,060 ord. and 7,059 pref. shares taken up; £1 per share called up on 31,352 ord. and 7,059 pref. shares; £38,411 paid; £55,708 considered as paid on 55,708 ord. shares. Mortgages and charges: Nil.

Electrical and Industrial Investment Co., Ltd.—Acknowledgement of indebtedness, dated April 18th, 1913 (given under trust deed dated August 12th, 1912), to secure £80,000 debenture stock, ranking *pari passu* with £100,000 debenture stock issued under trust deed, charged on company's undertaking and property, present and future. Trustees: Electric and General Investment Co., Ltd., 1-2, Great Winchester Street, E.C.

X. L. Electric Co., Ltd.—Debenture, dated April 1st, 1913, to secure £300, charged on company's undertaking and property, included uncalled or unpaid capital. Holder: Capt. C. Weener, Ewell Castle, Ewell, Surrey.

Ackroyd & Best, Ltd.—Issue on March 20th, 1913, of £100 debentures, part of a series of which particulars have already been filed.

Imperial Light, Ltd.—Issue on April 12th, 1913, of £1,000 debentures, part of a series of which particulars have already been filed.

Electromobile Co., Ltd.—Issue on April 23rd, 1913, of £459 debentures, part of a series of which particulars have already been filed.

CITY NOTES.

Rangoon Electric Tramway and Supply Co., Ltd.

THE directors' report that the amount of debenture stock available for future issue is £28,342. During the year to December 31st the company's cars travelled 1,462,285 miles, against 1,447,118 miles in 1911, an increase of 15,167 miles, and carried 10,633,328 passengers, against 9,569,922, an increase of 1,063,400; the receipts were Rs. 8,90,340, as compared with Rs. 8,42,033, an increase of Rs. 48,306, or 5·73 per cent. In the private lighting and power department the gross receipts for current supplied of all descriptions amounted to Rs. 4,80,232, as compared with Rs. 3,89,710 in 1911, an increase of 23·23 per cent.; the working expenses were 45·10 per cent. of the receipts, as against 46·13 per cent. for the previous year. The gross receipts of the house wiring and supply department amounted to Rs. 1,64,571, against Rs. 1,78,671 in 1911; although a slight decrease is shown in the total takings, the profit was Rs. 2,846 in excess of 1911, due to an improved system of working in this department and the increase in the demand for electrical articles of daily utility. The report, as given in the *Financier*, says that the general improvement thus shown is due, first, to the cessation of the economic disturbances that were severely felt in Burmah during 1911, and, secondly, to a healthy expansion observable in the company's operations. The gross profits were £56,793. Interest on debenture stock absorbed £8,950; provision for redemption of debenture stock, £5,481; depreciation on meters, uniforms, &c., in Rangoon, £973; transfer to reserve for renewals, £12,500; transfer to special reserve account for cables, &c., £3,000; fees for directors, managing director and trustees, and expenses in London, £2,218; leaving £23,872, plus amount brought forward, £728, making £24,601. Deduct preference dividend to December 31st, 1912, £15,000; leaving available for dividend on ordinary shares, £9,601. The directors recommend a dividend on the ordinary shares of 5 per cent., for the year, free of income-tax, absorbing £8,850, and carrying forward £751.

Willans & Robinson, Ltd. and Reduced.

MR. J. C. PEACHE (chairman) presided on Tuesday, at the Cannon Street Hotel, E.C., over the ordinary general meeting of this company.

In moving the adoption of the report (see page 735), the CHAIRMAN said they met that day under the revised articles of association. Since the original interests of the shareholders were now represented by the "B" preference stock, the result of the half-year's working was of interest to them chiefly in regard to its bearing on the ability of the company to meet the dividend obligations on that stock. The result for the half-year was a small profit of £154, not in itself a subject for congratulation, but it was an encouraging indication for the future. This improvement was in the main due to the increased business obtained towards the end of 1911 and during the year 1912, thus keeping the shops more fully employed than had been the case for some time past, and making possible an increased output in the half-year now being considered, with the accompanying marked improvement in the accounts which that half-year showed. In regard to the future, the progress made since January 1st pointed to a continuation and extension of this improvement. A further satisfactory volume of orders had been obtained, and the output of the works continued to be good. The Diesel engine business was extending in a most satisfactory manner, and this extension had been especially marked since the opening of the present year. It was too early to speak of the effect of reconstruction on the actual work of the business, for until the confirmation of the Court was obtained last month, no step could be taken in bringing the new connection into operation, and beyond the taking up of the agreed proportion of ordinary share capital, the incoming parties had not as yet been in a position to actively foster the business, although small orders had already been received from that source. The reconstruction had, however, indirectly been of material benefit to the company. As an example, he might mention that two important contracts running into some £50,000 had recently been obtained, the orders being placed with the company, subject to the reconstruction scheme passing the Court. That was to say, had the reconstruction scheme failed to go through the company would have lost these two important contracts. This fact emphasised the urgent need there was of the reconstruction. There was every indication that the dividend requirements of the "B" stock would be met as they fell due, and, indeed, the directors had reason to believe that the obligations on the "B" stock would be more than covered—a matter of especial interest to the shareholders in that the "B" stock was also entitled to one-tenth of surplus profits. In the circular accompanying the report and accounts, the directors had called the shareholders' attention to the issue of £80,000 "A" preference capital, with its attendant right to acquire ordinary shares. This "A" stock was offered, in the first instance, to W. & R. shareholders, and the offer was an advantageous one. The issue ranked next to the debenture issues, and a reserve fund equal to one year's dividend on both the "A" and "B" stock had to be created and maintained before the ordinary shares received more than a nominal dividend; also the total of the "A" capital being limited to £30,000, there should be no difficulty in meeting the dividend requirements. He should remind them that this issue of "A" capital carried with it the right to take up 20 per cent. of the 1s.

ordinary shares. These ordinary shares were entitled to all surplus profits after the dividends on the two preference stocks had been met. W. & R. shareholders thus had the opportunity of securing an interest in the prosperity which there was every reason to hope would fall to the lot of the company in the future. The present meeting—though held under the revised articles—must be looked upon as a transition meeting, since it dealt with a period coming under the previous constitution. Meetings in the future would be held annually instead of half-yearly, and the next meeting, which would be held in the spring of 1914, would deal with the first complete year's accounts of the reconstituted company.

MR. F. R. DAVENPORT (managing director), in seconding the motion, said he would like to endorse what Mr. Peache had said regarding the improvement shown in the last half-year. The additional work produced and invoiced in that period was the fruit of orders secured in the previous six or 12 months. Most of these orders, he need hardly say, were obtained with no little difficulty in view of their weak position, but the pursuit of these in the face of such difficulty was now bringing its reward. The contracts and orders more recently secured were of an improved character, and he had every reason for thinking that the current year's output would be a good one, and would yield a return on the reduced capital, which would be satisfactory. Steam turbine plants for the production of power on a large scale would remain the company's principal product, but the Diesel oil-engine trade was steadily increasing, and the policy of releasing themselves from the position of manufacturing a limited number of engines for another party to sell, which they would recollect prevailed for some time, had proved itself to be a good one. Contracting direct with the customer as they did now, they were establishing an excellent record for reliable and accurate work, so essential in Diesel business, which could not fail to be an advantage in the future. At present they confined themselves to the land issues of the engine, but were ready, if conditions warranted it, to start the building of certain marine types, for which, in years to come, there would be a great demand. Apart from these two most staple lines of production, they were extending the range of their manufactures and looked forward to including in that range business due to the "interests which animate the reconstruction scheme." In conclusion, he would remind them that the greatest asset they possessed to-day was the renewed confidence on the part not only of those they sold to, but also of those they bought for, without which no business could succeed; and it followed from the scheme of capital arrangement which the shareholders recently agreed to. He very much hoped that the present shareholders would avail themselves of the opportunity of taking up a portion of the new capital, so as to share in the improved outlook for the future.

The report was adopted without discussion, and the auditors having been re-elected, the proceedings terminated.

National Telephone Co. (in Liquidation).

A GENERAL meeting of the members of the above company was held on May 1st at Hamilton House, Temple Avenue, E.C., Mr. George Franklin (the liquidator) presiding.

The CHAIRMAN said it appeared to him that the usual practice of calling shareholders together and merely telling them what had been done would not be sufficient in a company of the size and importance of that, and, therefore, they had circulated the report and accounts. Dealing with the first complete year of the liquidation from January 26th, 1912, to January 25th, 1913, the principal items were the receipt of the three millions in cash on account of the purchase money and four millions in Exchequer bonds, which only realised £3,718,419. Their interest from the Postmaster-General's investments realised an amount of £575,808. The receipts from those amounts enabled them to discharge the entire amount of the debenture stock, the three kinds of preference shares and the preferred stock. It also enabled them to pay the premium of 5 per cent. on the preferred stock, and there had been arbitration and liquidation expenses amounting to £113,000. On January 25th last £8,709 of dividends remained uncollected by the owners, and he was sorry to say that £5,500 still remained uncollected. Coming to the realisation account, the total assets were £17,421,393. They had to deduct from that the reserve funds which the company had provided amounting to £4,645,944, and there were special reserves and other provisions which the company had made, but which were not required, which amounted to another £305,131, so that they had a total of £4,951,075 of reserves to deduct from the total assets. That left them with £12,470,318, as against the amount of the award by the Railway and Canal Commission of £12,515,264. If they added to the amount of the award the sum realised from investments, sundry debtors, and cash in hand, they were able to carry forward a balance of £674,755. To that should be added certain receipts by way of interest from the Postmaster-General, both interest paid and interest which they hoped was still to be paid, and the estimated value of other assets not yet recovered, making up a total of £990,539. From that they proposed to take off arbitration and liquidation expenses paid amounting to £71,600, and the estimated balance of disbursement by the Postmaster-General on behalf of the company up to January 25th last, estimated at £30,000, making a total of £101,600. Then came the premium of 5 per cent. on the re-payment of the preferred stock, £111,250; and interest on debentures, £8,638. The loss on the realisation of the Exchequer bonds amounted to £281,580, and the further estimated loss on bonds yet to be realised amounted to £350,000, giving a total of £631,580. The estimated surplus available, subject, of course to the liquidator succeeding in the appeal of which notice had been given by the Postmaster-General, was £137,470. Referring to the loss on the Exchequer bonds, he said that by the purchase agreement of 1905 the Postmaster-General had the option of paying three-fourths of the purchase-money awarded by the arbitrators in the form of what were called terminable annuities. The annuities were exchanged into Exchequer bonds because they believed they were a more marketable form of security than the annuities would have been, and the present position was entirely due to the fall in the value of Government securities since the date of the purchase agreement. In 1905 the highest price of Consols was 90¾, and the lowest 86½; to-day the price of Consols was 74$\frac{7}{16}$. The Postmaster-General had been constantly urged that he ought not to exercise his option under the agreement because of this injustice to the company. They contended that the award meant value; and, in the second place, it was contrary to the intention of the agreement when made, because, if Government securities, instead of diminishing so rapidly in value as they had done, had risen in value, they felt sure that the Postmaster-General would certainly not have exercised his option, and given them those Exchequer bonds. With the Postmaster-General it had been a case of "heads I win and tails you lose." However, the Postmaster-General had insisted on the exercise of his option, but he had consented in response to representations to the issue of those Exchequer bonds which were a more marketable form of security. He might tell them that nearly 17 per cent. of the award was swallowed up by that loss. He had heard comments as to the discrepancy between the large sum which the company claimed, and the amount which was awarded. If they took the total plant value comprised in what were known as headings 1 and 4 of the company's claim, they had an estimated sum of about £11,300,000, against the amount awarded by the Court for plant value, £10,239,345. If they took the overhead charges—and it was there where the company had greatly suffered—the claim amounted to £8,964,851, whereas the sum awarded was £3,335,974. As to depreciation, the company allowed £2,633,245 on their total claim, and the Court awarded a depreciation of £3,115,523 upon the amount awarded. They had a total claim of £20,924,700, and the total amount awarded by the Court was £12,515,264. The company's claim was equal to £37 5s. 6d. per station, including land and buildings, and the amount awarded was £22 5s. 11d. per station. In the House of Commons the Postmaster-General congratulated Parliament that the arbitration was over, but he had evidently forgotten that he himself had given notice of an appeal on certain points. After 31 years of existence a great business, with a gross income of nearly £4,000,000 a year, had passed over to the State. The shareholders, during the company's life, had never received more, and had often received less, than 6 per cent. per annum, and in the end, so far as they could see it now, the capital only might possibly be all that would be repaid to the shareholders. It was not an encouragement to invest in enterprises where the State had the right to purchase. He was quite sure that the company and its officers had no occasion for reproach. At the outset, the State insisted that the telephone was a telegraph, of which it had a monopoly. The State having granted a licence, and the company having provided the capital and ventured upon the enterprise, it had been subjected to the monstrous injustice of competition, the payment of an exorbitant royalty, and the refusal of proper privileges wherewith to carry on its business, which was the business of the public. The history of the company was of one continuous struggle against iniquitous restrictions, taxation, oppression and difficulties. The chairman, in concluding, said that there was no resolution to propose to the meeting, but he would be pleased to answer any questions.

In replying to shareholders, the CHAIRMAN said that, with reference to a distribution on the deferred shares, that depended upon the result of the appeal of which the Postmaster-General had given notice. When that was decided, they could proceed to make up the accounts.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in—

Letters Patent Insurance Co., Ltd.—22,148 ordinary shares of 1s. each, full paid (Nos. 1 to 19,548 and 294,549 to 297,148).

London and Suburban Traction Co., Ltd.—1,411,409 ordinary shares of £1 each, fully paid (Nos. 1 to 1,411,409); 1,018,178 5 per cent. cumulative preference shares of £1 each, fully paid (Nos. 1 to 1,018,178); and £144,441 4½ per cent. first mortgage debenture stock.

And to allow the following securities to be quoted in the Official List:—

Central London Railway.—£1,423,899 guaranteed assented ordinary stock, £460,976 guaranteed assented preferred stock, and £609,499 guaranteed assented deferred stock, in lieu of similar amounts of ordinary, preferred and deferred stock.

Pennsylvania Water and Power Co.—$8,495,000 capital stock in shares of $100 each.

Craigpark Electric Cable Co., Ltd.—The accounts for the year ended March, 1912, show a net profit of £7,437, plus £191 brought forward, making £7,628. The directors recommend that there be placed to depreciation off buildings and machinery, £1,800; dividend on 47,500 6 per cent. preference shares, £2,850; dividend on 37,500 ordinary shares, at 5 per cent., for the year, £1,875; balance of cost of new issue of preference shares, £183; balance to be carried forward (subject to payment of directors' fees for the past year), £920. The directors report the continued steady expansion of the company's business. All departments are fully employed, and the number and value of orders in hand are satisfactory. The stocks have been carefully gone over by the managing director, and are certified by him as being correct.

The meeting is called for May 12th at Glasgow.

Chiswick Electricity Supply Corporation, Ltd.

THE directors' report for the year ended December, 1912, says that the returns from the undertakings owned by the Corporation at Chiswick and Aberystwyth show good progress, and the increase in the number of consumers added during the year is satisfactory. During the year £2,634 has been expended on capital account for machinery, mains, services, &c. £615 has been written off for depreciation, and it is proposed to place a further £535 to depreciation reserve fund account, making a total contribution for the year, £1,150.

At December.	Number of consumers.	Revenue.	Profits.	Total liabilities on share and loan account.
1909	1,875	£15,129	£7,592	
1910	2,081	£15,404	£7,534	£142,800
1911	2,237	£16,338	£7,363	
1912	2,418	£18,322	£7,902	

The profits for the year, after paying sinking fund premium and trustees' fees, were £7,903. Out of this, interest on first mortgage debenture stock, amounting to £3,600, has been paid, leaving a balance of £4,303 to the credit of the net revenue account. The increase in the revenue for the year is £1,984. As influencing the profits, the account for repairs has been rather heavy, owing to an accident to one of the engines at Chiswick, while depreciation has been written off amounting to nearly twice as much as in the previous year. At Chiswick the cost of coal per unit has been higher than in the previous year, for the reasons that the price of coal was greater, and was very high during the strike, and that at the higher output a larger proportion of the units has to be generated non-condensing. As the result of experience with the Diesel engine at Aberystwyth, the directors have for the extensions required at Chiswick placed a contract for the supply and fixing of a similar type of engine, from the use of which considerable economy in fuel is expected to result. The results of the year's working will enable a dividend of 6 per cent. for the year to be paid. This dividend the directors propose to pay to the West London and Provincial Electric Supply Co., Ltd. Sir T. Brook-Hitching, who has occupied the position of chairman since the formation of the company, has resigned that position on account of ill-health, but he has consented to remain a director. Mr. Harry Kahn waselected chairman.

United River Plate Telephone Co., Ltd.

THE annual meeting took place in London on April 29th, Mr. Geo. Franklin presiding. The chairman referred with very deep regret to the death of Sir Irving Courtenay, who was their chairman for over 26 years. The board had nominated him (Mr. Franklin) to fill the office. He hoped in that position, with the continued confidence of his colleagues on the board, and of the shareholders, to be able to do something to keep the company no less prosperous in the future than in the past. It was with regret also that he announced the death of Mr. C. H. Menzies, of the Local Committee out in Buenos Ayres. Regarding the company, he was very much impressed with the extraordinary growth of its business, and of the prospects before it at the present time. The truth was that they had outgrown the habiliments of their youth. Their articles of association were insufficient, likewise their capital plant and machinery. They had outgrown everything. The telephonic business in Buenos Ayres had increased so rapidly that they had been forced on several occasions to enlarge their plant. The accounts, as arranged at the last annual meeting, were made up to December 31st, instead of March 31st, which meant they only applied for a period of nine months. The revenue for that period from subscriptions had amounted to £400,068, as against £351,744, in the proportionate period of the previous year, which meant an increase of £48,324. The expenses in River Plate and in London amounted to £281,465, as compared with £244,038 for the same period of the previous year, or an increase of £37,427, but there was an increased profit for the period of £10,897. The increase in expenses was largely due to the enhanced cost of living in Argentina, consequent upon which wages and salaries had had to be increased. They had also incurred extra expense by placing the wires underground and by substituting one type of plant for another. During the period under review, the capital account had been increased by the amount of last year's issue of shares (40,000 shares), and the reserve for renewal of plant had been increased by £99,750, notwithstanding the writing off of special charges for replacement of the type of plant he had mentioned, and capital expenditure during the period had been increased by £270,767, of which £250,325 was in respect of plant, and £20,442 on account of real estate and buildings. There was an increase of the stock of meters of £38,000, due to the general expansion of the business, and to the difficulty of getting telephone material quickly from the manufacturers, whereas the frequent delays in the Argentine Custom house made it necessary to keep larger stocks against emergencies. A dividend at the rate of 8 per cent. per annum was again recommended. £30,000 had been added to the reserve fund account, which would make that fund total £237,792. It was also decided to put £2,000 to the staff provident fund. It was also anticipated during the present year to extend the scope and usefulness of that fund. He would like to mention that just recently a serious fire was started in one of their principal exchanges, but was quickly extinguished by the chief engineer, who was somewhat badly burned. It showed that the company was possessed of a right loyal staff, who did not at any time shrink from their duty. That being the case, he thought they ought to do as much for the Staff Provident Fund as possible. Since 1903 the Argentine had steadily progressed. In that year the imports amounted to £26,000,000, but last year they reached £73,000,000, and the exports had increased to even a greater extent. He mentioned those facts as the prosperity of the company was locked up in the prosperity of the country. With the right kind of emigrant, the Republic ought to keep on advancing on the road of progress; 10 years ago their plant and real estate figured in their balance-sheet at about £450,000, but now it stood at something like £2,000,000. He would like to mention, however, that their exchanges were just about reaching their full limit or capacity. Any further progress would have to be accompanied by an increase in their plant. One thing, however, which affected them somewhat was the shortage of operators, in spite of the fact that they had a school attached to the works where they trained young people to become operators, eventually drafting them into the company's exchanges. Another thing which seriously hampered them was the fact that the Government out there would only grant fresh options on the understanding that those options reverted to the possession of the Government with all appurtenances, after 30 years' use, without any payment to the company whatever. They trusted, however, to get a modification of that decree, otherwise the company would be mulcted in some very heavy losses in a few years' time. This year the board had decided to ask the shareholders for a small premium of 10s. per share, which sum would be transferred to the reserve fund for the purpose of increasing the future earning power of the company. He hoped the shareholders would agree to that proposition. It would leave a fair margin of profit for them. It brought a sum of £27,000 to their reserve, which would be invested in land and buildings and plant. That would render their financial position very strong in spite of all the difficulties which he had enumerated. A new issue of 54,000 ordinary shares would be forthwith made to the ordinary shareholders at the price of £5 10s. per share.

MR. KEITH seconded the adoption of the report.

MR. T. CRAWLEY said he noticed in the papers the other day that the municipal authorities were inviting tenders for the construction of telephone tubes underground and underground tunnels for other purposes. He wanted to know if that would affect the future of the company. He should also like to know whether the company's service compared favourably with the London Telephone Service.

The CHAIRMAN said that the authorities had been inviting those tenders for many years, and if nothing else came of it, as in the past, they had nothing to fear. On the other hand, if more underground tunnels were constructed, the company would not be slow to take advantage of them.

Replying to MR. LOWE, the CHAIRMAN said he did not think they had much to fear in the way of competition from other companies, if they kept up their progressive methods.

MR. LONG, chairman of the Monte Video Telephone Co., said he had the pleasure some time ago of staying in Buenos Ayres, and during that stay made an inspection of the company's exchanges, works and other buildings. He also had many occasions to use the service, and he had to say he found it most satisfactory. He could not help being struck with the methodical way in which things were managed, and the shareholders had every cause to congratulate themselves.

A vote of thanks to the staff was carried with acclamation.

MR. PARKER, the manager in Buenos Ayres, in thanking the meeting for the vote, said it was reported in the papers recently that a severe storm had destroyed a large number of the telephone apparatus, but he would like to say it was not their company which was affected, as most of their cables were underground.

A vote thanks to the chairman, proposed by MR. KINGSBURY, concluded the business of the meeting.

Singapore Electric Tramways, Ltd.—The directors' report for the year ended December 31st, 1912, states that in October, 1912, the capital was reduced to £100,000 by reducing the nominal value of each share from 20s. to 5s. The accounts (says the *Financial News*) show an excess of revenue over expenditure of £34,439, the profit for the year, after charging debenture interest, depreciation, and royalty paid, being £5,358. Compared with the year 1911, tramway revenue shows an increase of £1,446. The lighting and power receipts continue to improve, being 17 per cent. higher than in 1911, and 59 per cent. higher than in 1910. The ratio of total expenses to total receipts in Singapore for the year is 52·66 per cent., or, taking only tramway working and tramway receipts, 57·25 per cent. The directors report that, after lengthy negotiations with the Municipal Commissioners of Singapore, the company has been able to secure an extension of the arrangement under which it supplies current for lighting and power purposes. A reduced scale of charges has been agreed upon, and it has been decided that the residential district of Tanglin shall be added to the present area now served by the Municipality. The contract is to be extended for 10 years from the date electric current is supplied to this new area.

R. S. Stokvis & Zonen, Ltd.—The directors propose to pay a dividend of 15 per cent. on the ordinary shares for 1912, to transfer to special reserve fund £13,531 and £17,045; managing directors' commission, £7,416. There will be carried forward £22,071.

Prospectus.—*Consolidated Gas, Electric Light and Power Co., of Baltimore.*—The list was to close on Wednesday in an issue of £700,000 5 per cent. consolidated mortgage debenture stock at 96.

Oriental Telephone and Electric Co., Ltd.

The annual meeting was held on April 30th, at the Great Eastern Hotel, E.C., Mr. B. St. John Ackers presiding.

The Chairman, in proposing the adoption of the report, said the directors were pleased to be able to report another prosperous year and a satisfactory increase in the business of the company. They had given their unremitting attention to that business for many years past and watched its progress closely, so that they considered themselves on this occasion in a position to recommend a higher dividend, making 10 per cent. for the year. The board had of course always felt that, with the yearly improving position of the company, the shareholders were fairly entitled to receive from time to time, as far as prudent, the benefit of increased profits; but, as he pointed out in a previous address, the directors, before giving effect to any desire they might entertain to distribute part of such increased profits among the shareholders, must be reasonably satisfied that there would be no going back. Acting on that principle, they had gradually accumulated considerable funds which were available at very short notice. They had in addition recently increased the company's holding of Consols to £20,000, and increased also the amount of their stores for sale purposes, besides spending a large amount on profitable new construction, whilst the company's investments in the affiliated companies, which were all in a highly prosperous condition, were, as they knew, very valuable. The revenues from their own exchanges, as well as those from the affiliated companies, had, during the last five years, not only maintained the increases shown annually, but had each year exhibited an increase over the previous year, and there was every evidence of these conditions continuing on their present moderate but very steady scale, so that the directors had come to this decision with every confidence in the future. It would be noticed that they had written down the total capital expenditure very considerably—below, in fact, the value placed upon their numerous installations by their different managers—and having regard to those installations being kept up in the highest state of efficiency, there would really be very little further to write off for some years to come. That condition of efficiency applied equally to their affiliated companies, so that the directors had felt justified in revising at the same time the very low valuation they placed upon their investments in these companies many years ago, and they would accordingly find their value increased in the balance-sheet to what was still a very low figure. As regarded the company's house property, he need hardly say that every care was taken to maintain this also in thorough repair and in the best possible condition. He took that opportunity again to refer to the ability and zeal with which the staff at home and abroad had worked to bring about the results which they showed, and for this the thanks of the shareholders and the board were justly due. The directors had decided the question of dealing with the pension fund by commencing investing the allotted sums in the names of two of their body to hold in trust on behalf of the company for the purpose of applying the interest to the payment of certain pensions to duly qualified members of the staff whenever the necessity for such pensions should arise. They had recommended £2,000 for this fund for the past year, raising it to £5,000, and they proposed to add substantial amounts every year.

Mr. Thomas Lloyd seconded the motion, which was adopted.

Anglo-American Telegraph Co., Ltd.

The ordinary general meeting of this company was held on April 29th, at Winchester House, E.C.

Mr. F. A. Bevan, who presided, said that they received a fixed amount annually for the use of their cables from the Western Union Telegraph Co. They had, therefore, no questions to deal with as regards increase or decrease, and he had not to tell them anything about the management or expenses of the company. That was all carried on by the Western Union Co., who did not furnish them with any figures at all, but were very prompt in paying the annual rent of £262,500. The credit side of the accounts showed as regards the renewal fund that they had come to an arrangement with the Western Union Co. whereby the cost of new cables was borne by the Anglo Co., but all renewals and repairs to those cables were met by the Western Union. On that account the Western Union Co. were creditors to the extent of about £20,000, which would have to be taken from the company's renewal fund. The Western Union, however, were bound to keep all their cables in good repair during the term of the lease. In the revenue account the shareholders would notice that a sum of £1,621 appeared in the form of bank interest. That arose by reason of the deferred shareholders only receiving their dividend at the end of the year. The Western Union Co. paid to them the full quarter's dividend, which they could not distribute to the deferred shareholders until the end of the year. Therefore, a certain amount of interest accrued in respect of that sum, with which he hoped in course of time the company would pay a bonus to the deferred shareholders. Since they made the arrangement with the Western Union, and during the past year especially, efforts had been made by the Press, aided by the Postmaster-General, to reduce the rates of telegraphic messages chiefly by a ring system. What the result would have been he did not pretend to know, but although there might have been an increase in the number of messages, at the same time a loss might have been made. It, therefore, seemed to him that the directors were wise, and the shareholders also, in agreeing to the arrangement with the Western Union. It was much more easy for the Western Union to bear any loss in that direction which might have accrued owing to a reduction of tariffs. Another thing they had to consider was whether an amalgamation of the deferred and preferred stock would be beneficial to the company. The directors were favourably disposed to amalgamating, but he understood several of the large preferred shareholders were opposed to the scheme. There was an argument on both sides. It would, however, be undoubtedly an advantage for them to have only one class of stock to deal with. He could not help noticing at that meeting that several familiar faces were gone. Sir Charles Burt, who was one of their most valuable directors, had passed away, and Sir Gerald Fitzgerald also. He should also like to mention that Mr. Carson had retired from the position of manager. That was a fact to be deplored. That gentleman had thrown his whole heart into the work, and had always given them of his best. Mr. Wells, who was secretary for a great many years, had also retired, likewise their old friend, Mr. Smith (the accountant). The old people passed away, but still the company went on as successfully as ever, and he trusted that when they had passed away the old Anglo-American would still be flourishing, occupying the proud position of being the first company to carry messages under the sea.

Mr. Benson seconded, and the motion was carried.

At the extraordinary general meeting held afterwards, the Chairman proposed a resolution adopting new articles of association. He said that the old articles were prepared many years ago, and were some of the first made under the Companies' Act. They were now quite obsolete, and the new conditions in connection with the arrangement with the Western Union made it imperative that certain alterations should be carried out.

The motion was carried.

Anglo-Portuguese Telephone Co., Ltd.—The accounts for the year 1912 record a healthy state of affairs. Contrasting the profit and loss account with that of 1911, the income for the year at £62,919 marks an increase of £5,874, but the operating and other expenses at £37,723 are £6,205 higher. Notwithstanding this factor, the directors are in a position to recommend a final distribution at the rate of 5 per cent. per annum, making 8 per cent. for the year, which was the rate for 1911, and which enables them to carry forward £5,609, which is slightly in excess of the sum brought into the account from 1911. A satisfactory feature of the accounts is the gradual increase in the amount of subscriptions received or charged in advance, less royalty and rents paid in advance, which appears as a liability in the balance-sheet at £25,859, and which, of course, represents the proportion of subscriptions unearned at the close of the financial year. If the present rate of increase both as regards the revenue and the reserves be maintained, the position is distinctly encouraging. The reserves total £75,000, which includes £12,500 appropriated from the year's accounts.

West London and Provincial Electric Supply Co., Ltd.—The directors' report for the year ended December, 1912, says that the company derives its revenue from the dividends on the shares of the Chiswick Electricity Supply Corporation, Ltd., which it owns, from the fees charged for managing the affairs of that Corporation, and from commission for acting as engineers in respect of additions to the Corporation's plant and machinery. The report of that company appears elsewhere. The 6 per cent. on shares in that company will be received in due course by this company, whose accounts show a balance to the credit of the profit and loss account of £3,485. The directors propose to pay a dividend on the cumulative preference shares at the rate of 6 per cent. per annum for 1912, and to pay interest at the rate of 4½ per cent. per annum on the funding certificates for the year ending 1911, carrying the balance forward. Sir T. Brooke-Hitching, who has occupied the position of chairman since the formation of the company, has resigned that position on account of ill-health. He has consented to remain a director. Mr. Harry Kahn was elected chairman.

Alderley and Wilmslow Electric Supply, Ltd.—The directors report for the year ended December 31st, 1912, that the total lamp connections have increased from an equivalent of 22,866 to 24,898 8-c.p. lamps. The result of the year's working shows a profit of £2,846, which, with £184 brought forward, makes £3,031, and after paying £1,766 interest on debentures and loans, there remains a balance of £1,245, of which the directors recommend that £800 should be put to reserve fund, and the balance, £445, carried forward.

Vera Cruz Electric Light, Power and Traction, Ltd.—The directors report that the net profits in Mexico for the year 1912 amount to £31,785, an increase of £3,901. After providing for London office expenses and bond and other interests, there remains a balance of profit of £16,744, plus £1,514 brought forward, making £18,259. From this there is transferred to depreciation and general reserve account £5,000; dividend on the share capital for 1912 at the rate of 2½ per cent., £8,750; carry forward, £4.509. The contract with the Puebla Tramway, Light and Power Co. for the supply of power, referred to last year, has been settled on satisfactory terms, and it is anticipated that power will be available before the end of 1913.

Kent Electric Power Co.—Notice appeared in the *London Gazette* on May 2nd of the company's intended application to Parliament this session for powers to rearrange the capital, convert shares, repeal or amend certain Acts, and other matters.

Colombo Electric Tramways and Lighting Co., Ltd.

The eleventh annual meeting of the above company was held on Wednesday at the offices, St. Benet's Place. The meeting was private. The report for the year ended December, 1912, which was adopted, stated that there was a total net profit in Ceylon for the year, after deducting all current expenses, amounting to £38,041. During the year 2,456,290 units were generated, as against 2,328,032 for the previous year, the cost per unit being slightly less. The tramways receipts show a further marked improvement. The total number of passengers carried amounted to 9,884,969, as against 9,114,633 for the previous year. The lighting branch of the company's business continues to show satisfactory progress. In consequence of the steady growth of the lighting branch, and also extension to the tramway track, orders have been placed for additional machinery and rolling stock. The appeal to the Supreme Court respecting the ferry service has not yet been decided. The total available profit, after providing for debenture interest and all expenses, and including the balance brought forward, amounts to £36,506. Out of this the directors have transferred £15,000 to general reserve and renewal fund, which had been dealt with by writing off £1,000 from the track renewal account, and £4,000 from the mains and plant account, leaving the general reserve and renewal fund at £35,000. The directors recommended a dividend of 10 per cent. on the share capital, free of income-tax, amounting to £13,084, leaving £8,422 to carry forward. The directors placed on record their appreciation of the work of the staff.

British Westinghouse Electric and Manufacturing Co., Ltd.

The thirteenth annual meeting was held on Monday at Hamilton House, Victoria Embankment, E.C., Mr. J. Annan Bryce, M.P., presiding.

The Chairman, in proposing the adoption of the report (see Elec. Rev., p. 732), said that dealing first with the debit side of the balance-sheet, the capital authorised and issued remained as before. The item, 6 per cent. prior lien debentures, was reduced by £6,300 in respect of 63 debentures drawn on December 13th, 1912, for repayment on January 1st, 1913, in accordance with the provisions of the trust deed, making in all £28,800 redeemed to date out of the profits of the company; 4 per cent. mortgage debenture stock remained as before, viz., £1,241,353. Prior lien redemption account represented the liability for the repayment of 63 debentures on January 1st of this year, plus a small balance carried forward to this year's account. Interest accrued to date on prior lien debentures and 4 per cent. mortgage debenture stock included three months' interest to December 31st, 1912, on the former and six months' interest on the latter, both of which had since been paid. Sundry creditors and credit balances, £199,387, including £49,434 reserve against maintenance on uncompleted contracts, stood at practically the same figure as last year, which was satisfactory having regard to the increased business. Advantage had been taken wherever possible by using their cash resources to obtain special cash discounts for payments before due dates. The reserve for employers' liability had been increased to £10,000, at which figure the board proposed to maintain it in the meantime. He might repeat what he said last year, that, owing to the care exercised in their shops, they had hitherto been singularly free from accidents of a serious nature. Turning to the credit side of the balance-sheet, the item "patents and goodwill" remained as before. Some of their patents had lapsed and some had been abandoned, but new patents had been acquired, the expenses connected with which had been defrayed out of revenue. For the sake of simplification they had this year, with the approval of the auditors, amalgamated the two items of works, machinery, plant, &c., starting with £1,672,677, the total of the two items shown in the 1911 balance sheet. The reserves of £51,912 which appeared in last year's accounts and which were the accumulation of several years, had been appropriated to various items comprised in the total sum mentioned of £1,672,677, and the amount put to depreciation in the present accounts, viz., £49,750 represented the amount written off for this year only, as previously there had been charged to revenue account a large sum for upkeep and maintenance of buildings and plant. Stock and material on hand, &c., £641,985, compared with £622,264, showing a slight increase over last year due to the expansion of business. Completed work on contracts, £249,310, compared with £292,024, showing a difference of £42,714. The smaller amount outstanding was satisfactory. In regard to the Underground Electric Railways Co. of London arbitration account, £95,681, the decrease of £23,916 was approximately accounted for by the result of the appeal to the House of Lords, under which the Railway Co. returned to them the amount of the original award, thus leaving them in the same position as before the award was given. The amount outstanding was still considerable, the exact value of which, to them, must depend upon the result of the further reference to the arbitrator. Sundry debtors—less reserve, £237,193, was some £56,000 odd in excess of last year owing to the increase of the business. Ample reserve was made for bad and doubtful debts which, considering the volume of business, constituted but a very small percentage. Shares and debentures in other companies were slightly less than last year owing to certain depreciations having been made with regard to some of the minor items. Bills receivable, cash at bankers and on loan amounting altogether to £115,677, compared with £61,718 last year, showing an increase of £53,959. This increase was partly due to better terms of payment and the careful attention paid to collections. Coming to the profit and loss account, the trading profits of 1911 amounted to £126,144, as compared with £112,539 in 1910. In 1912 they amounted to £157,871, or an increase of £45,332 over 1910, and £31,727 over 1911. This result was encouraging. The prospects for the current year were so far promising. Orders received this year were in advance of those booked up to the same time in 1912. The first three items on the debit side were the same as last year. Expenses on surplus land and buildings had been reduced from £4,254 to £3,033. This reduction was mainly due to the fact that they were now fully occupying the steel foundry building for the manufacture of other products. Amount written off works, machinery, plant, &c., £43,450, was £12,582 more than was devoted to this purpose last year. The net profit for the year, £41,074, showed an increase over the same item last year of £20,366, and compared as follows with recent preceding years:—December 31st, 1908, loss £6,521; December 31st, 1909, loss £799; December 31st, 1910, profit £12,437; December 31st, 1911, profit £20,708. There had thus been a continued steady improvement. Towards the close of his remarks last year, he alluded to the effects of the coal strike. Owing to this strike, their output was very considerably hampered. Their own supply of coals was adequate, but many of their suppliers were not in the same position, and it was really not until towards the end of the year that they returned to normal conditions of output. But for the strike and the additional cost of production caused by insurance payments and rise in wages, their results would have been considerably better. Although with this year's profit, and the amount brought forward, there was now available £66,899, the directors did not propose to recommend any distribution. In the first place they did not yet know what the loss would be in respect of the item "Underground Electric Railways Co., of London." Secondly, they did not consider that even with the reduction of capital effected in 1907, the assets had been written down to an amount adequate in the case of an undertaking such as theirs. While, therefore, they were undoubtedly in a better position than last year owing to the success of their appeal to the House of Lords, the board was still of the opinion that it would be wise to reduce the capital. As he said last year, the interests of the preference shareholders would not suffer in any way by such reduction.

Mr. E. A. Goulding, M.P., seconded the motion. He said it was clear from the lucid statement of the chairman that the company was in an improved position, and they had to recollect that it was under the chairmanship of Mr. Bryce that that had been brought about. The shareholders had been very patient, and he believed, if they exercised that patience a little longer, they would be rewarded in the success of the company. He saw a bright future before it, for all the difficulties had been faced and met instead of being covered up.

Replying to a shareholder, the Chairman said he did not think Mr. Lyttleton, the arbitrator, had yet fixed a date when he would deal with their claim against the Underground Railways Co. They would have to wait the result of that award before they proceeded to do anything further in the way of cutting down the preference shares. He would remind the holders of those shares that it really did not matter what their nominal value was. The question was—what was the value of the shares in the market, and what dividends would be paid on them? If the nominal amount was reduced it would become much more easy to declare what appeared to be a reasonable dividend.

Mr. Bibks said that as one who had attended every meeting of the company, he rather expected that the chairman would have spoken in a more cheerful tone as to the future. If there was to be any further reduction in the capital he thought it ought to be made in the ordinary shares. He would like to know what was likely to influence the policy of the board in regard to the reserve funds.

The Chairman said he did not see how it was going to hurt the preference shareholders if their shares were further cut down, so long as they received their interest. It did not matter to them whether the ordinary shares were similarly dealt with. Those shares belonged almost entirely to the American company, which also held a majority of the debentures and the preference shares, so it would be necessary to get their consent before they could do anything. They must remember that the American company came to their assistance and subscribed very large sums to pull the company through its troubles, and therefore they deserved consideration.

Mr. Bull asked whether there was any chance of a working combine between the different electrical companies in this country. He said he knew of another large company which was doing as much business as it possibly could, but yet could not pay a dividend on its ordinary stock.

The Chairman said it was very difficult to say whether there was any possibility of bringing about any general arrangement between the various electrical firms in the country. They had tried for years to avoid cutting prices, but it was a very difficult thing to bring about a general arrangement of that kind.

The report was adopted.

City of Buenos Ayres Tramways Co. (1904), Ltd.—The directors have declared a dividend of 1s. 3d. per share, less income-tax, for the quarter ended March 31st.

Tramways and General Works Co., Ltd.—A dividend of 16¾ per cent. (1s. per share), free of income-tax, has been declared for the year to March 31st.

Chloride Electrical Storage Co., Ltd.—The directors have declared a dividend of 10 per cent., free of tax, on the ordinary shares for the year. £8,407 is carried forward.—*Financier*.

La Plata Electric Tramway Co., Ltd.

Mr. W. F. Hamilton (chairman) presided on April 29th at Winchester House, E.C., over the fourth annual general meeting.

In moving the adoption of the report, he said the board regretted that the result of the working of the tramways for 1912 was so disappointing, although the total receipts on revenue account amounted to £53,179, being an increase of £3,126 as compared with the receipts of the previous year. The expenditure increased from £35,380 to £43,397, leaving a balance only of £9,782. The board had decided to write off out of this sum the whole of the defalcations account, and the expenses in connection therewith, and to recommend the payment of four months' dividend on the preference shares, covering the period from July 1st to October 31st, 1911, and to carry forward £598, to next year. As the 170,000 preference shares issued to the public were not fully paid up until August 1st, 1911, the dividend was 4·65d. per share. The decrease in their profits was large, but it was almost entirely due to causes of an exceptional nature, some of which could not happen again. During the whole year the weather at La Plata was very bad and deprived them of traffic which, in the normal course of things, would pass over their tramways, and there was a loss of £1,385 on their horse tramway to Ensenada. In addition to these causes, alterations were made in their routes as further portions of tramline were electrified, which entailed the running of much unprofitable mileage, and the great delay in the completion of the Ensenada section necessitated the payment of interest during a considerable part of the year on unproductive capital. All works of construction by their contractors were now entirely finished. Two short extensions to the Digne remained to be carried out, but they had till June, 1914, to do this in, and the work would be done in the most economical manner under the supervision of the manager. One of the first improvements effected by their new manager, Mr. Valentine Brown, after his arrival at La Plata, was to take advantage of the opening of the Ensenada section, to so modify the service of the tramways as to secure the best results, both for the company and the public. He had also completely reorganised the La Plata office, and the board were pleased to inform the shareholders that in Mr. Brown they had a very capable and experienced manager. The board were of opinion, judging by the reports they had received from the manager, and the result of the first quarter of the year, that the profits of the working would probably not be less than £20,000. Several shareholders had written to the company with regard to the other system of electric tramways in La Plata, but this other system did not compete with their own so far as regarded the Ensenada section and the Tolosa section—which were both very profitable—and also the Los Hornos and Cemetery sections, whilst in La Plata itself their lines ran in opposite directions. When he was at La Plata recently it was agreed between himself and the proprietors of the other tramways, that in making extensions competing lines should, as far as possible, be avoided. Their relations with the Government and the municipal authorities continued to be excellent. The present position of the action against their late local auditor was that appearance in the action had been entered on behalf of two of the defendants. The delay in the proceedings had been entirely due to the fact that the remaining defendant was travelling in South America, and it had been difficult to effect service of the writ upon him for that reason. The company had passed through troublesome times, and they had had many difficulties to contend with, but the prospects were favourable; and with the growth of La Plata and Ensenada, which was bound to continue, they might reasonably look forward year by year to increased profits.

Mr. W. T. Western seconded the motion.

Answering Mr. Van Raalte, the Chairman said he had gone very carefully into the question of the working expenses per car-mile, and they were not extravagant, but, of course, with an increase of receipts, the working expenses would diminish proportionately.

The report was adopted.

Lisbon Electric Tramways, Ltd.

The directors report a net profit of £102,745 for 1912, plus £4,466 brought forward, making £107,212. From this £35,000 has been placed to depreciation reserve, and £5,000 to the credit of exchange reserve account. Out of the available balance of £67,212 the usual preference dividend, amounting to £25,533, has been paid. On November 1st the directors paid on the ordinary share capital an interim dividend of 3 per cent. net, amounting to £19,020, and now recommend the payment of a final dividend at the same rate, making 6 per cent. net for the year 1912. £3,637 has been carried forward. The operations during the year were again affected by strikes. On May 29th a strike occurred amongst the tramway employés, owing to the men insisting on the reinstatement of certain of their number who had been discharged for insubordination. This strike lasted until June 24th, when the bulk of the cars were again in operation. The damage to the plant was trifling. Since that date the service has been continued without interruption. It is estimated that the total stoppage of the tramway during the strike resulted in a loss of about £20,000 in traffic receipts, but, owing to the satisfactory traffic during the remainder of the year, this loss has been mostly made up, and the net decrease on the year, compared with the previous year, amounts to £7,060. The exchange ruling during the year has been less favourable than in the previous year, the average rate being 48½d., as against 49·11d. After prolonged negotiations with the municipality of Lisbon, a contract was eventually agreed upon with that body, and finally signed in January last, for the reconstruction and electrification of the lines of the Nova Companhia dos Ascensores Mechanicos de Lisboa, in which system this company has a considerable interest.

Brisbane Electric Tramways Investment Co., Ltd.—The directors announce that the revenue account for 1912, including £6,574 brought forward, shows an available balance of £82,006, which, says the *Financier*, the directors have dealt with as follows:—Debenture stock interest, £19,068; preference dividend, £17,656; an interim dividend of 4s. per share on the ordinary shares, £18,000. Out of the remaining balance of £27,281 the directors recommend that £5,500 be added to the reserve fund, bringing it up to £10,000; that a balance dividend of 4s. per share, free of income-tax, be paid on the ordinary shares (making a total dividend for the year of 8 per cent.), and that £3,781 be carried forward. After the above appropriation the renewal and other reserve funds of both companies will amount to £113,000, with an aggregate of balances carried forward of £8,909.

STOCKS AND SHARES.

Tuesday Evening.

By another of those violent *voltes-face* to which the Stock Exchange is becoming accustomed, markets swung round completely this week, on the news that King Nicholas had consented to evacuate Soutari. The Stock Exchange humorists at once declared that he had closed his "bear" of Canadas and Rio Tintos, regardless of the consequences of so obvious a slander. This little joke, however, was one outcome of the much happier frame of mind that prevailed all round the markets, and the "bear" points were forgotten as prices rushed up generally.

The Electricity sections took the alteration in sentiment with the same quiet philosophy that they displayed through the previous slump. Changes on the week are mostly in the upward direction, so far as those securities are concerned in which there is any sort of speculative account, while the possibility of money growing easier, if the situation in Central Europe is really better, holds out hope to the investment markets.

On May 1st a number of stocks and shares quoted in the Stock Exchange daily Official List were removed from its pages in consequence of there having been no bargain recorded in them for a period of 16 months. Amongst those which were deleted in this way were several which appear week by week in our lists, such, for instance, as Dublin United Tramways Preference and Newcastle-on-Tyne Electric Preference. The paucity of general interest is our excuse also in removing them from their accustomed places. It will not be difficult to fill up the gaps with some of the other stocks and shares constantly added to the lists of those connected with the electrical industry.

English electric supply issues present their usual quota of something less than half-a-dozen changes on the week. Charing Cross and City Preference eased off to 4, but South Londons are up ⅛, and Edmundson's 6 per cent. non-cumulative Preference have again come into demand, showing a rise of $\frac{5}{16}$ at $2\frac{1}{16}$, while the Ordinary at 10s. are likewise better. South Metropolitan 4½ per cent. Debenture stock gained 2 points at 99, and the improvements recorded last week have been maintained.

Members of the Stock Exchange were amongst the audience at the demonstration given last week of the Cold Light, invented by Prof. C. F. Dussaud. Full particulars appeared in some of the papers, and the Stock Exchange men agreed that it was extremely interesting, likely also to exert a far-reaching influence over the electricity supply industry when the Cold Light developments have been carried further into commercial use. At the present time, they are not regarded as of sufficient immediate consequence to have much effect upon quotations for the supply companies' shares.

The Home Railway market was one of the principal gainers by the improved political news. Prices shot up in very vivacious fashion, assisted by the announcement that the scale of charges, both for passengers and goods, was to be increased in many directions. Of the Tube stocks, Metropolitans jumped 1¼ and Districts ¾ to 52⅞ and 39¾ respectively, but the prices of both had been acutely depressed just previously. The only change in City and South London stocks was a point rise in the 5 per cent. Preference of 1903, and Central Londons did not move. Important improvements are already being made on the systems of both these last-named lines, accelerated services being one of the principal achievements of the new control. Great Northern and City Preferred fell 1s. 3d. to 2⅜; but East Londons were a better market, moving up to 9¼. Underground Electric shilling shares eased off nominally, though, as a matter of fact, the actual price remains about 11s. 9d., while the £10 Ordinary rose 1s. 8d. The 6 per cent. First Income Debenture stock shows a loss of a point at 110. In the British Electric Traction group a fall of ¼ in the 5 per cent. Perpetual Debenture lowered the price to 90, and the Preferred at 84½ is a point down. Bath Tramways Debenture continues to dwindle.

The Telegraph market is firm on the whole, although there are one or two falls. Direct Spanish Preference rose ¼, "China" shares ⅛, and Commercial Cable Debenture ½. West India and Panama shares, on the other hand, fell to 2¾ upon the appearance of the report, which, after all, must be regarded somewhat in the nature of an interim one, inasmuch as the company is not expected to benefit largely until the Panama Canal is open. The dividend for the year remains at 1¼ per cent., and the price, after being dull, as just mentioned, braced up to 2⅛ later on. Reuters new shares hardened to 11, and Anglo-Portuguese Telephone Debenture stock rose 1½ to 102 upon the publication of a report that was read as being very satisfactory.

The features of the week, however, have been Marconi shares and National Telephone Deferred stock. Marconis put on good fractions, both as regards the Ordinary and Preference, thanks to the appearance of the report of the Technical Committee, which is looked upon as evidence that the Marconi Company possesses the best wireless system now in existence. Prices of shares in the subsidiary companies hardened with those of the parent, Canadians being particularly active at 16s. 9d., after dipping to 14s. 10½d. On Tuesday, however, the market became duller again. National Telephone Deferred rose to 21 upon further consideration of the figures to which reference was made here last week. Speculation in the stock revived languidly, but amongst actual holders there is profound discontent at the way in which they have been paid off through the operation of the Post Office purchase. If the Postmaster-General happened to be the Member of Parliament for stockholders in the National Telephone Company, we venture to think that his seat at the present time would not be one of the most secure to be found in the constituencies.

News from Mexico continues to be read with a certain nervousness, but the falls in the prices of Mexican securities have been stayed. Mexico Light and Power Preference is a point down, but this stock was unaffected in the slump last week. The Common shares are 1 higher. Mexico Trams Common shares and the First Mortgage bonds are both lower. Monterey Fives fell a point. Other issues connected with this group show a firmer tendency. Brazilian Traction at 97½ is unchanged. The market went dull on expectation of a 10-million-dollar issue of Preferred shares. Rio Tramway bonds lost their trifling improvement of last week. Toronto Power Debenture hardened to par middle, and Electric Light of Cochabamba bonds have also improved. Vera Cruz Debenture stock was unaffected by the issue of a report this week which showed the company to be making good progress. The Anglo-Argentine Tramway division is steady. Calcutta Trams are ½ higher. The Baltimore Gas and Electric Debenture prospectus, particulars of which were given here last week, duly appeared on Monday; it must be said that the stock looks a cheap and good investment.

In the Manufacturing division, Callenders and Henleys are both better, but beyond these movements there is little to chronicle. Edison & Swan First Debenture eased off to 62. The rubber share market participated in the better tone shown by the Stock Exchange as a whole on Monday, and prices revived to some extent. With one exception, shares in the copper mining concerns went up gaily, and the prophets are as confident as ever that the metal itself will further improve.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month. £	Receipts for the month. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open.	Route miles open. Inc.
Bath	May 3	3,138	— 399	18	13,289	+ 231	..	..
Blackpool-Fleetw'd	„ 3	1,580	— 615	17	6,389	+ 201	8	..
Bristol	„ 2	28,514	+2,619	..	122,057	+11,572	30·5	..
‡Brit. Elec. Trac. Co.	April 25	94,373	- 648	17	368,660	+21,884	..	..
Chatham and Dist.	„ 24	2,334	- 291	16	18,518	+ 266	14·98	..
Cork	May 1	1,920	- 108	17	7,794	— 149	9·89	..
Dublin	„ 2	23,958	- 518	..	97,077	+ 577	54·25	..
Hastings	„ 1	3,431	- 385	..	..	— 644	19·3	..
Lancashire United	April 30	5,618	— 1	17	23,784	+ 2,274	39	..
Llandudno-Col. Bay	„ 25	817	— 124	21	3,717	+ 417	6·5	..
London United	„ 25	22,870	—4,5 1	..	90,510	— 3,635	..	..
Tyneside	„ 30	1,888	- 275	18	8,287	+ 407	11	..
Anglo-Argentine	„ 27	30,676	+24,927	..	948,255	+71,850	..	..
Auckland	„ 11	20,216	+2,744	..	199,511	+27,367	24·1	·8
Bombay (B.E.T.)	Feb. 27	12,56	+ 437	9	26,511	+ 629	..	..
Brisbane	March	26,870	+7,550	13	74,040	+31,486	..	..
Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	May 3	17,034	+1,845	..	..	+ 2,926	..	..
Cape Electric T. Ld.	..	..	..	..	..	..	..	..
Kalgoorlie, W.A.	March	2,862	..	13	8,210	..	20·5	..
Lisbon	..	..	..	..	..	..	..	..
Madras	April 30	3,691	+ 170	..	14,181	+ 1,114	14·7	2
Montevideo	April	30,087	+2,053	26	199,·62	+11,400	..	..
Cen. London Rly.	May 3	20,873	+4,023	18	95,5 6	10,[illegible]31	6·78	·4
City & S. Lon. Rly.	„ 3	11,6·0	— 424	18	53,784	— 4,143	7·26	..
Dublin-Lucan Rly.	„ 2	933	- 26	18	2,103	+ 99	7	..
G.N. and City Rly.	April 26	5,3·6	— 374	17	25,986	— 3,378	3·5	..
L'pool Overh'd Rly.	„ 27	6,25[illegible]	+ 199	18	26,8·4	+ 1,543	6·6	..
London Elec. Ry. Co.	May 3	58,175	+4,940	18	261,775	+ 4,1·0	31·25	..
Mersey Railway	„ 3	8,788	+ 657	18	4·,514	+ 2,674	4·5	..
Metropolitan Rly.	April 27	61,988	+2,1·7	17	277,1·2	3, 65	25·75	..
Met. District Rly.	May 3	52,181	+3,297	18	237,134	+11,482	25	..

* Compared with the corresponding period of 1912.
‡ Includes horse, steam and other receipts.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, May 7th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	per lb.	2¾d.	..
a „ Sulphuric	per cwt.	5/6	..
a Ammoniac Sal	„	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£29 10	..
a Bleaching powder	„	£6 5	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£17 10	..
a Copper Sulphate	„	£23 5	..
a Lead, Nitrate	„	£27	..
a „ White Sugar	„	£25 5	..
a „ Peroxide	„	£32	..
e Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (88/90 %)	per ton	£22 10	..
a „ Chlorate	per lb.	3½d.	..
a „ Perchlorate	„	4½d.	..
a Potassium, Cyanide (98/100 %) (for mining purposes only)	„	7½d.	..
a Shellac	per cwt.	£0/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	„	£6 10	..
a „ Recovered	„	£5 10	..
a „ Lump	„	£5	..
a Soda, Caustic (white 70/72 %)	„	£10 5	..
a „ Chlorate	per lb.	3½d.	..
a „ Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	3d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£95	..
b „ Wire, in ton lots (1 to 14 S.W.G.)	„	£112	..
b „ Sheet, in ton lots	„	£126	£6 inc.
p Babbitt's metal ingots	„	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	8½d.	..
c „ Tube (brazed)	„	10½d.	..
c „ „ (solid drawn)	„	9d.	..
c „ Wire, basis	„	8½d.	..
c Copper Tubes (brazed)	„	10½d.	..
c „ „ (solid drawn)	„	9½d.	..
g „ Bars (best selected)	per ton	£85	..
g „ Sheet	„	£85	..
g „ Rod	„	£85	..
d „ (Electrolytic) Bars	„	£72 10	..
d „ „ Sheets	„	£89 10	..
d „ „ Rods	„	£77 10	..
d „ „ H.C. Wire	per lb.	9½d.	..
f Ebonite Rod	„	4/6	..
f „ Sheet	„	4/-	..
n German Silver Wire	„	1/10	..
h Gutta-percha, fine	„	7/- to 8/-	..
h India-rubber, Para fine	„	3/6½	1d. inc.
i Iron Pig (Cleveland warrants)	per ton	67/9	7½ dec.
l „ Wire, galv. No. 8, P.O. qual.	„	£14	..
g Lead, English Pig	„	£17 10	£1 5s. dec.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£7 10	..
e Mica (in original cases) small	per lb.	6d. to 8s.	..
e „ „ „ medium	„	3/6 to 6/-	..
e „ „ „ large	„	7/6 to 11/-	..
o Nickel, sheet, wire, &c.	„	3/6 to 4/6 nom.	..
p Phosphor Bronze, plain castings	„	1/1 to 1/3½	..
p „ „ rolled bars & rods	„	1/0½ to 1/2	..
p „ „ rolled strip & sheet	„	1/2½ to 1/5½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	11d.	..
r Steel, Magnet, in bars	per ton	£55	..
g Tin, Block (English)	„	£232 to £233	inc.
n „ Wire, Nos. 1 to 16	per lb.	2/9	2d. inc.
p White Anti-friction Metals	per ton	£30 to £328	..
k Zinc, Sh's (Vieille Montagne bnd.)	„	£29	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

Ernest F. Moy, Ltd.—The directors report that during the year ended December 31st, 1912, a profit of £677 was earned, which, together with £262 brought forward, makes £939 to be dealt with. The directors propose a 6 per cent. dividend on the ordinary shares (less income-tax) £480; 6 per cent. dividend on the preference shares (less income-tax) £85; income-tax on profit, £39; balance to be carried forward, £335.

Calcutta Electric Supply Corporation, Ltd.—The directors have decided to recommend a final dividend on the ordinary shares at the rate of 10 per cent. per annum for the six months ended December 31st last, making 8½ per cent. for the year. Such dividend will be payable on 16th inst.

Eastern Telegraph Co., Ltd.—The directors recommend the payment of a final dividend of £1 5s. per cent. and a bonus of £2 per cent., both free of income-tax, making, with previous payments on account, a total distribution of 7 per cent. on the ordinary stock for the year ended December 31st, 1912.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations May 6th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord.	10	5½	6	9⅞ — 10⅛	..	5 18 5
Do. 4½ % Pref.	10	4½	4½	8¾ — 9¼	..	4 14 9
Do. Second 6 % Pref.	10	6	6	10 — 10¼	..	5 14 3
Do. 4½ % Deb. Stock	Stock	4½	4½	96 — 98	..	4 11 10
Brompton & Kensington, Ord.	5	10	10	8¾ — 9⅛	..	5 6 8
Do. 7 % Cum. Pref.	5	7	7	8⅞ — 8¾	..	3 18 10
Central Electric Supply, 4 % Guar. Deb.	100	4	4	95 — 98	..	4 1 8
Charing Cross, West End & City	5	5	5†	4¼ — 5	..	5 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4¼ — 4⅝	..	4 17 4
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅞ — 4⅛	— ⅛	5 9 1
Do. Do. 4 % Deb.	100	4	4	91½ — 93½	..	4 5 7
Chelsea, Ord.	5	5	4†	4¼ — 5	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	96 — 99	..	4 10 11
City of London, Ord.	10	8	9	16 — 17½	..	5 6 8
Do. 6 % Cum. Pref.	10	6	6	12 — 13	..	4 10 7
Do. 5 % Deb.	Stock	5	5	116 —120	..	4 3 4
Do. 4½ % Second Deb.	100	4½	4½	100 —102	..	4 8 3
County of London, Ord.	10	6	6	10½ — 11	..	5 9 1
Do. 6 % Pref.	10	6	6	11⅝ — 12⅛	..	4 19 0
Do. 4½ % Deb.	Stock	4½	4½	104 —106	..	4 5 0
Do. 4½ % Second Deb.	Stock	4½	4½	97 —100 xd	..	4 10 0
Edmundson's, Ord.	£3	Nil	..	⅜ — ⅝	+ ⅛	Nil
Do. 6 % Cum. Pref.	5	Nil	3	4⅛ — 4⅜	..	..
Do. 6% Non-Cum. Pref.	5	..	..	1⅛ — 2⅜	+ ⅛	..
Do. 4½ % First Mort. Deb.	100	4½	4½	81 — 84	..	5 7 2
Folkestone	5	6	6	4½ — 5	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4½ — 5	..	5 0 0
Do. 4½ % First Deb.	100	4½	4½	90 — 92	..	4 17 10
Hove	5	9	9†	7¼ — 7⅜	..	5 16 2
Kensington & Knightsbridge, Ord	5	9	8†	7⅜ — 7⅝	— ⅛	5 14 8
Do. 4 % Deb.	Stock	4	4	90 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	76 — 80	..	5 12 6
London Electric, Ord.	3	2½	..	1⅜ — 1⅞	..	4 0 0
Do. 6 % Pref.	5	6	6	4⅜ — 5⅛	..	5 17 1
Do. 4 % First Mort. Deb.	Stock	4	4	91 — 94	..	4 5 1
Metropolitan	5	4	4†	3½ — 3⅝	..	5 6 8
Do. 4½ % Cum. Pref.	5	4½	4½	4¼ — 4⅜	..	4 17 4
Do. 4½ % First Mort. Deb.	Stock	4½	4½	9a —101	+1	4 9 3
Do. 3½ % Mort. Deb.	Stock	3½	3½	82 — 85	..	4 2 4
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	99 —102	..	4 8
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	97½ —100½	..	4 19 6
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9⅞ — 10⅜	..	5 11 7
Oxford	5	7½	6†	5⅞ — 6⅜	..	5 13 9
St. James' and Pall Mall, Ord.	5	10	10†	8½ — 9	..	5 11 1
Do. 7 % Pref.	5	7	7	6⅞ — 7⅛	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	84 — 87	..	4 0 6
South London, Ord.	4	5	6	2⅞ — 3⅛	+ ⅛	7 7 8
Do. 5 % First Mort. Deb.	100	5	5	97 —100	..	5 0 0
South Metropolitan, 7 % Pref.	1	7	7	1⅞ — 1⅞	..	5 17 11
Do. 4½ % First Deb. Stock	100	4½	4½	96 — 99	+ 2	4 10 6
Urban, Ord.	£3	Nil	..	¾ — ⅞	..	..
Do. 5 % Cum. Pref.	5	2	‡	2⅝ — 3⅛	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	83 — 86	..	5 2 3
Westminster, Ord.	5	10	10	8½ — 9	..	5 11 1
Do. 4½ % Cum. Pref.	5	4½	4½	5 — 5⅜	..	4 3 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5 — 5½	..	5 14 8
Calcutta, Ord.	5	8½	7†	6⅜ — 7⅛	..	5 19 4
Do. 5 % Pref.	5	5	5	4⅜ — 5⅛	..	4 17 7
Calgary Power, 1st Mort. Bds.	100	5	5	93 — 95	..	5 5 8
Canadian Gen. El. Com.	$100	7	7	115 —119	..	5 17 8
Do. 7 % Pref.	$100	7	7	120 —125	..	5 12 0
Cordoba Lt., Power and T., Ord.	1	8	..	⅛ — ⅜	..	5 14 8
Do. 5 % Deb.	100	5	5	94 — 96	..	5 4 2
Elec. Lt. and P. of Cochabamba, 8 % Bonds	100	6	6	98½ — 95½	..	6 6 0
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	90 — 93	..	5 7 6
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	95 — 97	..	5 3 1
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	⅛ — ⅜	..	Nil
Do. 6 % Pref.	1	6	6	⅞ — 31/32 xd	..	8 6 8
Kaministiquia Power, 5% G. Bs.	$500	5	5	100 —102	..	4 18 0
Madras, Ord.	5	Nil	..	1⅜ — 1⅞	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	102 —105	..	4 15 2
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	81 — 84	..	5 19 1
Mexican Lt. & Power, Common	$100	4	4†	75 — 78	+1	5 2 7
Do. 7 % Cum. Pref.	$100	7	7	101 —103 xd	+1	6 16 0
Do. 5 % 1st Mort. Gold Bds.	..	5	5	91½ — 93½	..	5 7 0
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	81 — 84	—1	5 19 1
Montreal, Lt., H. and Power	$100	8	9†	229 —234 xd	..	3 17 0
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5a	15 — 25	..	..
River Plate, Ord.	Stock	10	..	217 —227	..	4 8 0
Do. 6 % Non-Cum. Pref.	Do.	6	6	105 —110	..	5 9 1
Do. 5 % Deb. Stock	Do.	5	5	100 —102	..	4 18 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 8
Shawinigan Water, Capital	$100	5	5	137½ —142½	..	3 10 2
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 9
Do. 4½ % Per. Deb.	Stock	4½	4½	101½ —103½	..	4 7 0
Toronto Power, 4½ % Deb.	Do.	4½	4½	99 —101	+ ½	4 9 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	91 — 94	..	5 6 5
Victoria Falls Power, Pref.	1	11¼d.	17½d.	1⅛ — 1⅜	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	106 — 108	..	5 11 1

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4	4½†	6⅞ — 7⅛	..	6 2 0
Do. 5 % Deb. Red.	Stock	5	5	97 — 99	..	5 1 0
American Telep. & Teleg., Cap.	$100	8	8†	132 —134	..	5 19 6
Do. Collat. Trust	$1000	4	4	92 — 94	..	4 5 1
Anglo-American Telegraph	Stock	8	8	64½ — 66½ xd	— ½	4 10 3
Do. 6 % Pref.	Do.	6	6	110½ —112½ xd	..	5 7 8
Do. Def.	Do.	80/-	..	2¼ — 2½	— ⅛	6 2 5
Anglo - Portuguese Tel., 5 % Mort. Deb.	100	5	5	101 —103	+1½	4 17 1
Chili Telephone	5	7	8	7⅛ — 7⅜	..	5 1 1
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	84 — 86	+ ½	4 18 0
Cuba Telegraph	10	6	6	8¾ — 9⅛	..	6 6 4
Do. 10 % Pref.	10	10	10	16 — 17	..	5 17 8
Direct Spanish Telegraph, Ord.	5	4	4†	3¼ — 3⅜	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	6⅜ — 7¼	+ ⅛	6 18 0
Direct United States Cable	10	5	4	6¼ — 7	..	5 14 4
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	99 —101	..	4 9 0
Eastern Telegraph, Ord. Stock	Stock	7	7†	135 —138	..	5 1 5
Do. 3½ % Pref. Stock	Do.	3½	3½	77½ — 79½	..	4 8 1
Do. 4 % Mort. Deb.	Do.	4	4	94 — 96	..	4 3 4
Eastern Extension	10	7	7†	13¼ — 13⅝	+ ⅛	5 2 7
Do. 4 % Deb.	Stock	4	4	96 — 97	..	4 2 6
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	93 —100 xd	..	4 0 0
Globe Telegraph and Trust	10	6	6†	10⅜ — 11½	..	5 6 8
Do. 6 % Pref.	10	6	6	12⅝ — 13⅝	..	4 11 4
Great Northern Telegraph	10	18	20	30½ — 32½	..	6 3 1
Indo-European Telegraph	25	13	13	59 — 61	..	5 6 7
Mackay Companies Common	100	5	5	83 — 86	..	5 16 3
Do. 4 % Cum. Pref.	$100	4	4	69 — 72	..	5 11 1
Marconi's Wireless Telegraph	1	20	..	4⅜ — 4½	+ 1/16	4 9 0
Do. 7 % Cum. Partic. Pref.	1	17	..	8⅜ — 8½	+ ⅛	4 7 9
Monte Video Telephone, Ord.	1	6	5†	1 — 1⅛ xd	..	5 6 8
Do. 5 % Pref.	1	5	5	2 — 2⅛ xd	..	5 14 3
New York Telep., 4½% Gen. Bnds.	100	4½	4½	97⅜ — 98⅜	+ ⅛	4 11 2
Oriental Telep. and Elec.	1	8	6†	1⅜ — 1⅝	..	4 2 6
Do. 6 % Cum. Pref.	1	6	6	1⅜ — 1½	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	..	4 8 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	97½ — 99½	..	4 0 6
Reuter's	10	10	10†	11⅜ — 11⅝	..	8 12 0
Do. New Shares	10	..	..	10⅛ — 11⅛	+ ⅛	..
Submarine Cables Trust	Cert.	6	6	124 —127	..	4 14 6
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	96½ — 98½	..	4 11 5
United River Plate Telephone	5	3	..	7 7/16 — 7 11/16	— 1/16	5 4 1
Do. 5 % Cum. Pref.	5	5	5	5⅝ — 5⅞	..	4 9 0
West Coast of America	2½	2½	..	1¼ — 1½	..	4 3 4
Do. 4 % Debs., 1 to 500 guar. by Braz. Sub. Tel.	100	4	4	95 — 98	..	4 1 8
West India and Panama Teleg.	10	1½	1½†	2 3/16 — 2 5/16	— 1/16	4 1 8
Do. 6 % Cum. 1st Pref.	10	6	6	10¼ — 10⅝	..	5 11 7
Do. 6 % Cum. 2nd Pref.	10	6	6	9⅝ — 10	..	6 0 0
Do. 5 % Debs.	100	5	5	101 —103	..	4 17 1
Western Telegraph, Ltd.	10	7	7†	13 — 13½	..	5 3 8
Do. 4 % Deb.	Stock	4	4	95 — 97	..	4 6
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	96 — 99	..	4 11 0

*Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. ‡ 3s. in Funded Dividend Certs.

CONTINUED ON NEXT PAGE.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations May 6th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bath Trams, Pref. Ord.	*	Nil	Nil		..	Nil
Do. 5 % Pref.	1	5	5		..	6 8 1
Do. 4½ % Deb.	100	4½	4½	72 — 77	—1	5 17 0
Brit. Elec. Trac., 6 % Pref.	100	..	..		..	..
Do. Do. Deferred	100	..	..		..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	83 — 86	..	6 19 6
Do. 7 % Non-Cum. Pr'f.	100	..	..	32 — 35	..	..
Do. 5 % Perp. Deb.	100	5	5	88 — 92	— ½	5 8 8
Do. 4½ % 2nd Deb.	100	4½	4½	73 — 77 xd	..	5 17 0
Central London Railway, Ord.	100	8	8	82 — 84	..	14 15 3
Do. Pref.	100	4	4	84 — 86	..	14 13 0
Do. Def.	100	2	2	80 — 82	..	14 17 7
Do. 4 % Deb.	100	4	4	99 — 101	..	3 19 8
City & S. London, 6 % Pref., 1891	100	6	6	100 — 102	..	4 18 0
Do. Do. 1896	100	5	5	100 — 102	..	4 18 0
Do. Do. 1901	100	5	5	98 — 101	..	4 19 0
Do. Do. 1908	100	5	5	97 — 100	+1	5 0 0
Do. 4 % Deb.	100	4	4	91 — 93 xd	..	4 6 0
Great Northern & City, Pr'f. Ord	10	Nil	Nil	2⅛ — 2½	— ⅛	Nil
Hastings Trams, 6 % Pref.	1	6	6†	7⅜ — 7⅝	..	7 7 8
Do. 4½ % Deb.	100	4½	4½	66½ — 71½	..	6 5 5
sle of Thanet Trams, 5 % Pref.	5	2½	2½	2⅛ — 2⅜	..	4 15 3
Do. 4 % Deb.	100	4	4	75 — 80	..	5 0 0
Lancashire United, 5 % Deb.	100	5	5	73 — 80	..	6 5 0
London Elec. Railw'ys, 4 % Deb.	100	4	4	94 — 96	..	4 8 4
London United Trams, 5 % Pref.	10	Nil	..	4⅛ — 5	..	..
Do. 4 % Deb.	100	4	4	63 — 67	..	5 19 5
Metropolitan Railway Consol.	100	1½	1½	52¼ — 53	+1½	3 1 4
Do. Surplus Lands	100	2½	2½	62 — 64	..	4 6 0
Do. 3½ % Deb.	100	3½	3½	85 — 87	..	4 0 6
Do. 3½ % Pref.	100	3½	3½	82 — 84	..	4 3 4
Do. 3½ % Con. Pref.	100	3½	3½	80 — 82	..	4 5 4
Metropolitan District Ord.	100	Nil	Nil	39½ — 40	+ ¾	Nil
Do. 6 % Deb.	100	6	6	138 —140	..	4 5 9
Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Do. 4 % Prior Lien	100	4	4	96 — 98 xd	..	4 1 8
Do. 4½ % First Pref.	100	4½	4½	85 — 87	..	5 1 9
Do. 3½ % Gtd.	100	3½	3½	75 — 77	..	4 10 11
Metropolitan Elec. Trams, Ord.	1	5	5⅛	2⅞ — 3 xd	..	5 14 7
Do. 5 % Pref.	1	5	5	1⅛ — 1⅜	..	6 8 1
Do. 4½ % Deb.	100	4½	4½	87 — 91	..	4 18 11
Do. 5 % Deb.	100	5	5	91½ — 94½	..	5 5 10
Potteries, Ord.	1	5⅛	..	⅛ — ¼	..	..
Do. 5 % Pref.	1	6	6	19 — 20	..	6 19 0
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	5 3
South Metro. Trams, 6 % Pref.	1	6	..	1⅛ — 1⅜	..	7 7 8
Do. 4 % Deb.	100	4	4	65 — 70	..	5 14 4
Underground Elec. Railways	10	..	..	4½ — 4⅝	+ ⅛	Nil
Do. "A"	1/-	..	..	1/32 — 1/16	— 1/32	Nil
Do. 6% First Cum. Inc. Deb.	100	..	6	109 —111	—1	5 7 8
Do. 4½ % Bonds	100	4½	4½	97 — 99	..	4 10 11
Do. 6 % Income	100	1½	6 †	92 — 93	..	6 9 0
Yorkshire (West Riding), Ord.	5	Nil	..	⅛ — ¼	..	Nil
Do. 6 % Pref.	5	8	8†	8½ — 8¾	..	4 0 0
Do. 4½ % Deb.	100	4½	4½	81 — 85	..	5 6 0

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5½	5⅝	4⅜ — 5	..	5 8 7
Do. 2nd Pref.	5	5½	5⅝	4⅜ — 4⅝	..	5 14 3
Do. 4 % Deb.	100	4	4	90½ — 92½	..	4 6 6
Do. 4½ % Deb.	100	4½	4½	99 —101	..	4 9 1
Do. 5 % Deb.	100	5	5	99 —101	..	4 19 0
Auckland Trams, 5 % Deb.	100	5	5	101 —103	..	4 17 1
Bombay Elec. S. & Trams, Pref.	10	6	6	10⅜ — 11½	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	96 — 98	..	4 11 10
Do. 5 % 2nd Deb.	100	5	5	97 — 99	..	5 1 0
Brazilian Traction Light and Power	$100	..	6†	96⅛ — 98½ xd	..	6 1 10
Brisbane Trams Invt., Ord.	5	8	8†	7½ — 7⅝	..	5 5 0
Do. 5 % Pref.	5	5	5	4⅝ — 5⅛	..	4 15 8
Do. 4½ % Deb.	100	4½	4½	100 —103	..	4 7 5
B. Columbia Elec. Rly., Def.	100	8	8†	131 —134 xd	..	5 19 5
Do. Pref. Ord.	100	6	6	114 —117	+ ½	5 2 7
Do. 5 % Pref.	100	5	5	103 —106	..	4 14 4
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	100 —102	..	4 8 3
Do. 4½ % Con. Deb.	100	4½	4½	94½ — 96½	— ½	4 8 1
Calcutta Trams, Ord.	5	7	5†	5⅝ — 6⅛ xd	+ ⅛	5 14 3
Do. 5 % Pref.	5	5	5	4⅛ — 5⅛	..	4 17 7
Do. 4½ % Deb.	100	4½	4½	97⅛ — 100½	..	4 9 7
Cape Electric Trams	1	2½	..	⅛ — ⅜	..	..
City Buenos Aires Trams (1904)	5	5	5†	5⅛ — 5⅜	..	4 10 0
Do. 4 % Deb.	100	4	4	95 — 99	..	4 0 10
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	90½ — 94½ xd	..	5 5 10
Havana Elec. Rly., 5 % Bonds	$1000	5	5	97 —101	..	4 19 0
Kalgoorlie Elec. Trams	1	Nil	..	⅛ — ⅜	..	Nil
Do. 5 % A Deb.	100	5	5	88 — 88	..	5 13 8
Do. 6 % B Deb.	100	6	8	25 — 35	..	..
La Plata Elec. Trms, Ord.	1	Nil	..	⅛ — ⅜	..	..
Do. Pref.	1	6	..	1⅛ — 1⅜	..	5 13 0
Lisbon Elec. Trams, Ord.	1	6	6†	1⅜ — 1⅝	..	4 7 3
Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 16 0
Do. 5 % Deb.	100	5	5	92 — 97	..	5 3 1
Madras Elec. Tr. (1904), Deb.	100	5	5	103 —105	..	4 15 3
Manaos Trams & Lt., 1st Deb.	100	5	5	88 — 91	+1	5 10 0
Manila Elec. R. and Lig., Bonds	$1000	5	5	97 —100	..	5 0 0
Mexico Trams Com.	$100	7	7†	107 —109	..	6 7 10
Do. Gen. Con. 5 % Bonds	..	5	5	91½ — 93½	—1	5 7 0
Do. 6 % Bonds	100	6	6	97⅛ — 99½	..	5 0 7
Para Elec. Rlys. & Lt., Ord.	5	10	10	7 — 7½	..	6 13 4
Do. 6 % Pref.	5	6	6	4⅞ — 5⅛	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	99½ —101½	..	4 18 6
Perth (W.A.) Elec. Tr., Ord.	1	5	5⅛	1⅜ — 1⅛	..	3 14 5
Do. 5 % 1st. Deb.	100	5	5	105 —108	..	4 12 7
Rangoon El. Tr. & Sup., Pref.	5	6	6	5⅞ — 6⅞	..	5 0 0
Do. 4½ % 1st Deb.	100	4½	4½	97 — 99	..	4 10 11
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	101⅜ — 102⅜	..	4 17 4
Do. 5 % Mort. Bonds	100	5	5	95½ — 96½	— ½	5 3 8
Sao Paulo Tram, Lt. and P. 5 % 1st Deb.	$500	5	5	100½ — 103½	..	4 16 7
Singapore Trams, 5 % Deb.	100	5	5	83½ — 87½	..	5 14 3
Southern El. Tr. B.A., 5 % Deb.	100	5	5	96 — 98	..	5 2 0
Un. Elec. Trams Monte Video	5	7	6†	4⅞ — 5⅛	..	6 10 3
Do. 6 % Pref.	5	6	6	4⅞ — 5⅛	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	96 — 99 xd	+ ½	5 1 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	99 —102	..	4 8 3

MANUFACTURING COMPANIES.

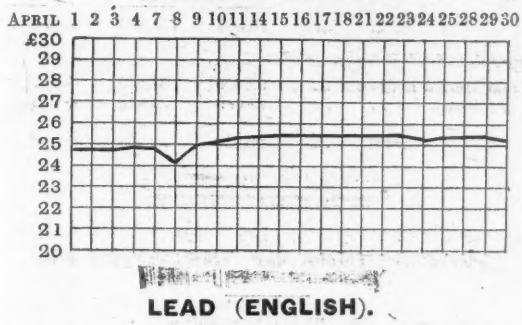
Aron, Ord.	1	6	..	⅛ — ¼	..	8 0 0
Do. 6 % Pref.	1	6	6	6⅞ — 7⅛	..	7 2 2
Babcock & Wilcox	1	28	16	3 — 3⅛	— 1/16	5 2 6
Do. Pref.	1	6	6	1⅜ — 1⅝	..	4 3 6
British Aluminium, Ord.	1	Nil	..	1/16 — 1/8	..	..
Do. 6 % Cum. Pref.	1	Nil	6	⅛ — ¼	..	5 17 2
Do. 5 % Prior Lien Debs.	100	5	5	93 — 96	..	5 4 2
Do. Deb. Stk.	100	5	5	84 — 87	..	5 14 11
B.I. & Helsby Cables	10	10	10	7⅜ — 8	..	6 5 0
Do. Pref.	5	6	6	5⅞ — 6⅛	..	4 16 0
Do. Deb...	100	4½	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	96 — 98	..	4 11 10
British Westinghouse, Pref.	8	Nil	Nil	⅜ — ½	..	Nil
Do. Deb...	100	4	4	63 — 67	..	5 19 5
Do. 6 % Prior Lien	100	6	6	98 —101	..	5 18 10
Browett, Lindley, Ord.	1	..	..	2/- — 3/-	..	Nil
Do. Pref.	1	..	..	4/6 — 5/-	..	Nil
Brush, 7 % Pref.	2	Nil	Nil	0 — ½	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	73 — 78	..	6 8 2
Do. 4½ % Deb	100	4½	4½	88 — 43	..	10 9 4
Do. 4½ % Second Deb.	100	4½	4½	25 — 29	..	16 18 4
Callender's Cable	6	15	10†	11¼ — 12½	+ ½	6 2 5
Do. Pref.	5	5	5	4¼ — 5⅛	..	4 17 7
Do. Deb...	100	4½	4½	98 —101	..	4 9 1
Castner-Kellner	1	20	20	3⅞ — 4	..	5 0 0
Do. Deb...	100	4½	4½	103 —106	..	4 4 11
Crompton & Co.	8	Nil	..	⅛ — ¼	..	Nil
Do. Deb...	100	5	5	56 — 57	..	9 15 6
Dick, Kerr	1	5	Nil	1⅛ — 1⅜	..	..
Do. Pref.	1	6	6	3¼ — 3½	..	7 13 10
Edison & Swan, A, £8 paid	5	Nil	..	⅛ — ¼	..	Nil
Do. fully paid	5	Nil	..	1⅛ — 1¼	..	Nil
Do. 4 % Deb.	100	4	4	60 — 64	—1	6 5 0
Do. 5 % Second Deb.	100	5	5	70 — 73	..	6 17 0
Electric Construction	2	2½	3⅛	1⅛ — 1⅜	..	5 14 4
Do. Pref.	2	7	7	1⅝ — 2	..	7 0 0
Greenwood & Batley, Pref.	10	7	7	7½ — 8	..	8 6 8
Do. Deb...	100	5	6	92 — 94	..	5 4 2
General Electric, 6 % Pref.	10	6	6	10 — 10½	..	5 11 7
Do. Deb...	100	4	4	88 — 93	..	4 6 0
Henley's, Ord.	5	15	15	12½ — 13	+ ⅛	5 15 5
Do. Pref.	5	4½	4½	4⅝ — 5	..	4 10 0
Do. Deb...	100	4½	4½	101 —103	..	4 7 5
India-Rubber, G. & T.	10	..	7½	11 — 12	..	6 5 0
Do. Pref.	10	5	5	9 — 10	..	5 0 0
Telegraph Construction	12	17½	20	36 — 38	..	6 6 2
Do. Deb...	100	4	4	96 — 99	..	4 0 10
Willans & Robinson	1	Nil	..	⅛ — ¼	..	Nil
Do. Pref.	5	Nil	..	⅜ — ½	..	Nil
Do. Deb...	100	4	4	57 — 59	..	6 15 7

Unless otherwise stated, all share are fully paid. † Interim dividend. ‡ Dividend of 4 per cent. guaranteed by Underground Electric Railways.

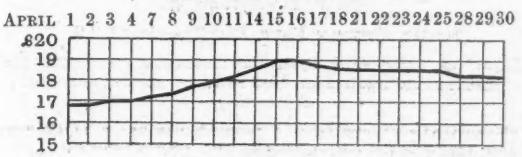
METAL MARKET.

Fluctuations in April.

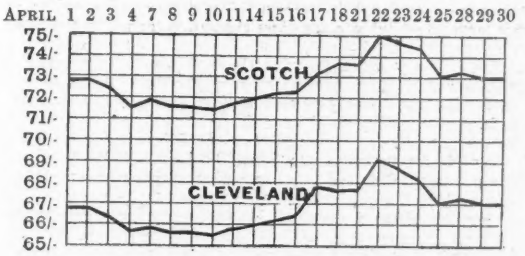
SPELTER (G.O.B's.).



LEAD (ENGLISH).



IRON.



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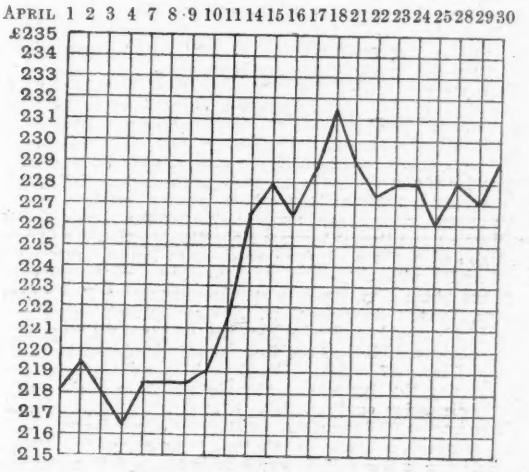
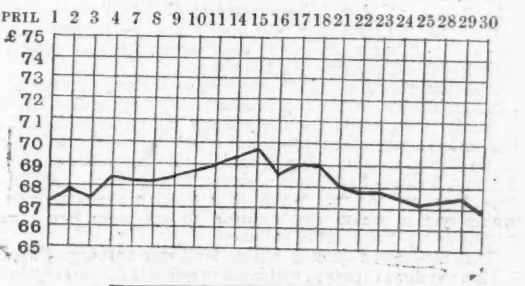


COPPER (G.M.B's.).



Cirencester.—The U.D.C. has decided to install an electrical recorder at the waterworks pumping station, at a cost, including poles and wires, of £157.

TRADE STATISTICS OF SOUTH AFRICA.

The following statement, showing the imports of electrical and similar goods into the Union of South Africa during the year 1912, has been taken from the recently issued official trade statistics. The figures for 1911 are added for purposes of comparison, and notes of any increases or decreases are given :—

	1911. £	1912. £	Inc. or dec. £
Detonators.—			
From Great Britain ...	23,000	30,000	+ 7,000
„ Germany	9,000	11,000	+ 2,000
Total ...	32,000	41,000	+ 9,000
Fuse.—			
From Great Britain ...	75,000	79,000	+ 4,000
„ Germany	37,000	46,000	+ 9,000
„ Other countries ...	2,000	1,000	— 1,000
Total ...	114,000	126,000	+ 12,000
Asbestos manufactures.—			
From Great Britain ...	500	3,000	+ 2,500
„ Other countries ...	1,700	2,000	+ 300
Total ...	2,200	5,000	+ 2,800
Brass Manufactures.—			
From Great Britain ...	24,000	37,000	+ 13,000
„ Germany	1,000	2,000	+ 1,000
„ Other countries ...	2,000	2,000	—
Total ...	27,000	41,000	+ 14,000
Copper, plate and sheet.—			
From Great Britain ...	4,000	4,000	—
Copper manufactures.—			
From Great Britain ...	2,000	4,000	+ 2,000
„ Other countries ...	1,000	1,000	—
Total ...	3,000	5,000	+ 2,000
Electrical cable and wire.—			
From Great Britain ...	152,000	142,000	— 10,000
„ Germany	62,000	30,000	— 32,000
„ Other countries ...	13,000	4,000	— 9,000
Total ...	227,000	176,000	— 51,000
Electrical fittings, including posts.—			
From Great Britain ...	139,000	170,000	+ 31,000
„ Germany	92,000	87,000	— 5,000
„ Holland	1,000	1,000	—
„ United States ...	19,000	23,000	+ 4,000
„ Other countries ...	9,000	8,000	— 1,000
Total ...	260,000	289,000	+ 29,000
India-rubber of all kinds.—			
From Great Britain ...	31,000	33,000	+ 2,000
„ Germany	5,000	2,000	— 3,000
„ United States ...	5,000	7,000	+ 2,000
Total ...	41,000	42,000	+ 1,000
Lamps and lampcare.—			
From Great Britain ...	19,000	19,000	—
„ Germany	18,000	16,000	— 2,000
„ United States ...	10,000	11,000	+ 1,000
„ Other countries ...	1,000	1,000	—
Total ...	48,000	47,000	— 1,000
Machine bands and belting.—			
From Great Britain ...	114,000	102,000	— 12,000
„ United States ...	37,000	29,000	— 8,000
„ Other countries ...	2,000	2,000	—
Total ...	153,000	133,000	— 20,000
Electrical machinery.—			
From Great Britain ...	170,000	140,000	— 30,000
„ Germany	318,000	238,000	— 80,000
„ United States ...	39,000	50,000	+ 11,000
„ Other countries ...	1,000	7,000	+ 6,000
Total ...	528,000	435,000	— 93,000
Cranes, elevators and lifts.—			
From Great Britain ...	30,000	33,000	+ 3,000
„ United States ...	3,000	4,000	+ 1,000
„ Other countries ...	—	2,000	+ 2,000
Total ...	33,000	39,000	+ 6,000

	1911. £	1912. £	Inc. or dec. £
Mining machinery.—			
From Great Britain ...	605,000	483,000	— 122,000
„ Germany	116,000	72,000	— 44,000
„ United States ...	145,000	128,000	— 17,000
„ Other countries ...	11,000	7,000	— 4,000
Total ...	877,000	690,000	— 187,000
Machinery not specially mentioned (other than agricultural, manufacturing, &c.).—			
From Great Britain ...	410,000	359,000	— 51,000
„ Germany	22,000	38,000	+ 16,000
„ United States ...	46,000	45,000	— 1,000
„ Other countries ...	10,000	12,000	+ 2,000
Total ...	488,000	454,000	— 34,000
Railway rails.—			
From Great Britain ...	6,000	13,000	+ 7,000
„ Belgium	10,000	4,000	— 6,000
„ Germany	60,000	51,000	— 9,000
„ United States ...	2,000	3,000	+ 1,000
Total ...	78,000	71,000	— 7,000
Telegraph and telephone material —			
From Great Britain ...	5,000	9,000	+ 4,000
„ Germany	1,000	1,000	—
„ Sweden	8,000	4,000	— 4,000
„ United States ...	—	1,000	+ 1,000
„ Other countries ...	2,000	2,000	—
Total ...	16,000	17,000	+ 1,000
Tramway rails.—			
From Great Britain ...	5,000	1,000	— 4,000
„ Germany	4,000	7,000	+ 3,000
„ United States ...	8,000	3,000	— 5,000
Total ...	17,000	11,000	— 6,000
Tramway rolling-stock.—			
From Great Britain ...	3,000	4,000	+ 1,000
„ United States ...	1,000	2,000	+ 1,000
Total ...	4,000	6,000	+ 2,000
Other tramway materials.—			
From Great Britain ...	8,000	9,000	+ 1,000
„ Germany	1,000	1,000	—
„ United States ...	4,000	1,000	— 3 000
Total ...	13,000	11,000	— 2,000

In addition to the above the following were imported as "Government Stores":—

Brassware.—			
From United Kingdom ...	5,000	4,000	— 1,000
Copper, plate and sheet.—			
From United Kingdom ...	15,000	19,000	+ 4,000
Electrical cable and wire.—			
From United Kingdom ...	65,000	57,000	— 8,000
„ Germany	1,000	2,000	+ 1,000
Total ...	66,000	59,000	— 7,000
Electric fittings.—			
From United Kingdom ...	15,000	14,000	— 1,000
„ Germany	—	1,000	+ 1,000
Total ...	15,000	15,000	—
India-rubber.—			
From United Kingdom ...	9,000	5,000	— 4,000
Lampware.—			
From United Kingdom ...	2,000	2,000	—
Cranes and elevators.—			
From United Kingdom ...	28,000	1,000	— 27,000
Electrical machinery.—			
From United Kingdom ...	14,000	22,000	+ 8,000
Other machinery.—			
From United Kingdom ...	52,000	58,000	+ 6,000
„ Other countries ...	3,000	4,000	+ 1,000
Total ...	55,000	62,000	+ 7,000

	1911. £	1912. £	Inc. or dec. £
Railway rails.—			
From United Kingdom ...	39,000	319,000	+ 280,000
„ Germany	25,000	53,000	+ 28,000
„ United States ...	—	44,000	+ 44,000
„ Belgium	6,000	34,000	+ 28,000
Total ...	70,000	450,000	+ 380,000
Telegraph and telephone material.—			
From United Kingdom ...	63,000	88,000	+ 25,000
„ Sweden	17,000	32,000	+ 15,000
Total ...	80,000	120,000	+ 40,000

PROCEEDINGS OF INSTITUTIONS.

On Phase-Advancing.

By Dr. Gisbert Kapp, Past President I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *April 24th*, 1913; *also at Birmingham and Newcastle.*)

If the current sent out from a power house has a lagging component, this may be compensated and the power factor brought to unity by connecting to the circuit some apparatus taking a leading current. A well-known form of such apparatus is an over-excited synchronous motor, and it has also been suggested to use an electrostatic condenser for this purpose. Whichever apparatus is used, the improvement takes place from the generator up to the point of attachment, but not beyond. The apparatus must therefore not be installed in the power house, for there it would only relieve the generators of wattless current, and not the line. Apart from this imperfection it can easily be shown that this method is wasteful both in capital outlay and in running cost.

To compensate for a power factor of 0·8 by a rotary condenser, the cost of the electrical plant will be increased by 60 per cent. over a generator designed large enough for this power factor—and the cost of the steam plant and the expenses for power will both be increased by about 4 per cent. Obviously it is a wrong policy to install the phase advancer side by side with the generator.

The same reasoning applies to an electrostatic condenser. The losses would probably be a little smaller, but to save 20 per cent. of generator volt-amperes we should have to put in 75 per cent. of condenser volt-amperes, obviously the reverse of a commercial proposition. We may thus dismiss at once the idea of installing any kind of phase-advancing apparatus in the power house, and turn to the only practical plan of putting such apparatus at the end of the line or on the customer's premises.

Here we may distinguish two cases. First the reduction of the phase angle of the installation as a whole without any change in the power factors of individual motors or other consuming devices; and secondly, the increase of the power factor of individual motors. The former plan is too expensive for general adoption and can only be justified if the cost of the line has a preponderating influence. It is the only possible method where the consuming devices are squirrel-cage motors, arc lamps, induction furnaces, and similar appliances; and then it becomes a question whether it will be more profitable to put in a phase advancer or to lay an additional line and install additional generators if the plant must be extended.

If the phase advancer is a synchronous motor it requires an exciter, starter and synchroniser. The cost of such a machine with its adjuncts would hardly be less than £2 per K.V.A. capacity, and every additional kilowatt set free for sale is obtained at a capital outlay of from £7 to £10. The financial position is not improved by replacing the dynamic machine by an electrostatic condenser. In the discussion on Prof. Miles Walker's recent paper, Mr. A. W. Ashton quoted £2·8 per K.V.A. as the cost of condensers, and this was afterwards corrected to £1·9 for a frequency of 50. For power transmission a lower frequency is desirable, and then the cost of condensers is proportionately increased. The static condenser can therefore in point of cost hardly compete with the dynamic condenser.

In the case of phase advancement applied to individual motors, as the dynamic condenser is not only used as a phase advancer but is also doing useful work as a motor, its cost must not be entirely debited to advancing the phase.

Phase-advancing by an idle running motor may or may not be a commercial proposition; phase-advancing by a loaded motor certainly is, especially for the power company, since their share of the cost can only amount to a part of what it would be if they had to do the phase-advancing by an idle-running motor on their own account, instead of getting a customer to help them. At the same time, they get the full benefit of a smaller phase angle over the whole system, which enables them to sell more power without having to lay down additional plant.

The over-excited synchronous motor has constancy of speed and a high overload capacity, which distinguish it favourably from the ordinary induction motor; but it is also distinguished unfavourably from the induction motor by the necessity of starting appliances being provided, including a synchroniser.

Some types of synchronous motors have been developed which do not require synchronising, and in which the starting appliance is

fairly simple. Of these types two may be mentioned: one has been perfected by the Lancashire Dynamo and Motor Co., and the other by the late Mr. Danielsen, of Vesteras, Sweden.

The Lancashire Dynamo and Motor Co.'s arrangement is shown in fig. 1. The outer circle represents a three-phase stator, and the inner circle a wound rotor. This rotor may be excited from a small dynamo *e*, and then it becomes the continuous-current field magnet of a synchronous motor, the stator being the armature. At starting, however, the rotor is not excited, but its winding is closed over the

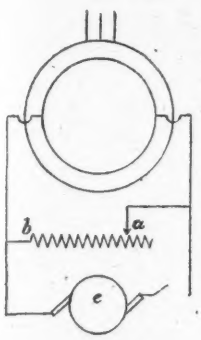


FIG. 1.

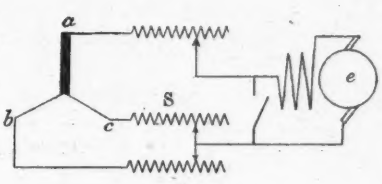


FIG. 2.

resistance shown, and then the rotor winding acts as the secondary circuit of an induction motor. The machine is started in the usual way by gradually reducing the resistance until the contact *a* has advanced to *b* and the whole of the starting resistance is short-circuited. The machine then works like an ordinary induction motor. If now the resistance is again inserted, and, at the same time, the exciting circuit of *e* is closed, the rotor becomes a continuous-current magnet and jumps into step. By the time the contact *a* has been completely withdrawn from the starting resistance the rotor is over-excited, and the machine, whilst giving power mechanically, acts as a phase advancer.

In the Danielsen arrangement (fig. 2) the three lines, *a*, *b*, *c*, represent the phases of the rotor of an induction motor. Phase *a* is shown by a thicker line to indicate that it has twice the copper section of the other two phases; S is the starter, and the contacts corresponding to the phases *b* and *c* are permanently connected. The contact corresponding to *a* is connected to the joined contacts over a small continuous-current series exciting dynamo *e* mounted on the motor shaft. During the starting period the connections to the dynamo are short-circuited, and the brushes are placed on the axis of the field so that the machine cannot excite.

The motor is started as an induction motor in the usual way, and when up to speed, *i.e.*, when the whole of the starting resistance is short-circuited, the exciting dynamo is inserted by opening the switch above mentioned. It will then be traversed by the rotor current, which has the very low frequency of the slip. Hence the self-induction of the exciter does not interfere with the working of the machine as an induction motor

If now the brushes are shifted into their working position the machine begins to excite not only itself, but also the rotor of the motor, transforming it into a continuous-current magnet. The current enters at phase *a* and passes out by the other two phases in parallel. This is the reason why the copper section of phase *a* is twice that of the other phases. The machine jumps into step and becomes a synchronous motor. The excitation is adjusted by shifting the brushes on the exciter.

A machine intended to act purely as a phase advancer is 24·5 per cent. larger than a machine intended to act purely as a motor and taking the same current.

If the machine is to act both as a phase advancer and as a motor, in an example given the cost of the motor is £120, of which £70 must be debited to it in respect of its being a motor and £50 in respect of its being a phase advancer. If this cost were borne by the power company it would mean that by the expenditure of £50 it purchases a market for an additional 25 KW. of saleable power. This is at the rate of £2 per KW. If, on the other hand, the customer is to pay the £2 per KW., he will expect a recompense in the shape of a lower tariff or a discount on the general tariff. This discount need not be large. Phase-advancing by a loaded synchronous motor thus becomes a commercial proposition.

It is possible to obtain phase advancement by injecting a leading E.M.F. into the secondary of an induction motor. This must necessarily react on the primary and thus reduce the original lag in it; and if carried beyond the requirements of the individual motor it may even produce a leading component of the current taken by the motor and so improve the power factor of the system as a whole.

A small natural slip is of far greater importance than a large natural power factor. If, then, an engineer is called upon to design a motor to work with a phase advancer, he should aim at a small natural slip, even at the cost of a somewhat reduced natural power factor; he will thereby get a cheaper motor and also a cheaper phase advancer, so that the cost of the set capable of giving unity power factor need not be greater than the cost of a motor designed to work alone. But in the latter case the power factor cannot be much over 0·9; so that the unity power factor is practically obtained without extra expenditure.

This theoretical conclusion is borne out in practice. In my laboratory at the Birmingham University is a Brown-Boveri induction motor of 25 H.P. fitted with a Scherbius phase advancer. At full load the set has unity power factor, and its efficiency is 88 per cent. The synchronous speed is 1,000 R.P.M., and the weight is 800 lb. The figures, 1,000 revolutions, 25 H.P., and 800 lb., agree fairly well with good English practice for induction motors having at full load a power factor of 0·9, so that in the case here cited the improvement of power factor is indeed obtained without any increase in material.

The Scherbius phase advancer, as well as that which Prof Miles Walker has recently brought to the notice of this Institution, belongs to what may be called the rotational type, because the leading E.M.F. is produced by the rotation of an armature in a magnetic field. There is, however, another principle which can be applied to phase advancement, viz. the free oscillation of an armature in a continuous-current field. To distinguish such a machine from the rotational type I call it a vibrator.

M. Leblanc was the first engineer to call attention to both the rotational and the vibrating principles of phase advancement, and he has patented an apparatus under the name "recuperator," in which the vibrating principle is used to produce phase advancement. The "recuperator" consists of a copper disk swinging within an annular unipolar field. The current flows through the disk radially between a rubbing contact at the centre and a mercury-trough contact at the circumference. To keep the field from oscillating, a second and fixed disk is placed parallel to the oscillating disk within the polar cavity, and so connected that the current flows through the two disks in opposite directions.

When the author designed his vibrator he was not aware of M. Leblanc's recuperator, but he willingly acknowledged M. Leblanc's priority in having been the first to draw attention to the fact that phase advancement may be produced by making use of the physical principle that a leading E.M.F. is generated in an alternating-current conductor allowed to swing freely in a continuous-current field.

Any continuous-current armature if traversed by an alternating current of low frequency will tend to vibrate, but with a machine of the usual proportions this tendency is too weak to be practically utilised. In order to get a serviceable phase advancer the armature must be bipolar, of small diameter and great length, the air-gap must be as small as mechanically possible, and the saturation of

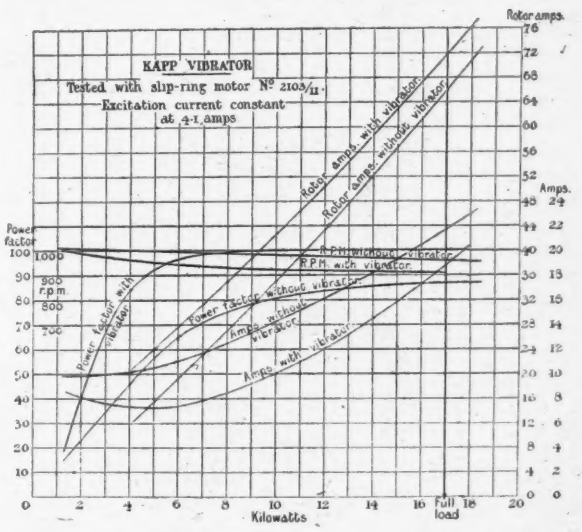


FIG. 3.

teeth and core must be very high, not only because a strong field is desirable, but also to avoid unbalanced magnetic attraction, which, with a small air-gap, would be unavoidable if the teeth were only moderately saturated. The leading E.M.F. injected by the vibrator is given by the formula—

$$e_v = \frac{0{\cdot}1}{m}\left(\frac{\phi}{\tau}\right)^2 \frac{I}{\omega},$$

where m = the mass of the armature in units of 9·81 kilograms reduced to its circumference, ϕ = the continuous-current field in megalines, τ = distance from wire to wire on the armature, $\omega = 2\pi f$, the angular speed corresponding to the slip frequency f, and I the current in amperes.

This formula may with sufficient approximation be also written thus—

$$e_v = 0{\cdot}1\,\frac{(\phi z)^2\, I}{G\,D^2\,\omega},$$

where z = the number of active conductors, and $G\,D^2$ = the fly-wheel effect of the armature in kilogram-cm.^{2}.

The output of each vibrator armature in volt-amperes is $e_v I$, and this is given by—

$$V\,A = 3{\cdot}8\,(\phi\,\Delta)^2/G\,\omega,$$

where Δ is the current density in effective amperes per centimetre of armature circumference.

It will be seen that the magnitude of the injected E.M.F. is pro-

portional to the ratio of current and slip frequency. Since this ratio decreases only slightly as the load decreases, the injected E.M.F. does not fall off proportionately with the load, but at a much lower rate, with the result that the effect of the phase advancer is relatively greater at low loads, and this is just what is wanted.

It is especially at low loads where there is greatest need for improving the power factor. This effect will be seen in fig. 3, which represents test results obtained with a vibrator made by the Sandycroft Foundry Co. (I am indebted to Mr. Hunt for these curves.) At one-quarter load the power factor is already 0·87, and at half-load it is unity, maintaining this value up to full-load and beyond.

Fig. 3 gives also the primary and secondary currents and the speed, both with and without the vibrator. It will be noticed that the effect of the vibrator is to decrease the primary current considerably and to increase the secondary current slightly; this means, on the whole, a smaller copper loss in the motor.

A photograph of this phase advancer is reproduced in fig. 4. The three pairs of field cores and the common yoke frame are in one casting without any joints. The only machining required is the boring of the polar cavities and the facing-up of the surfaces to

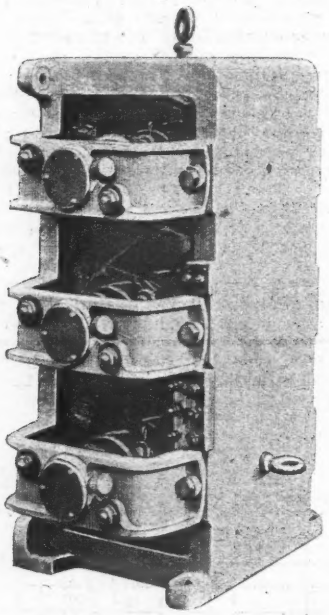


FIG. 4.

which the bearing brackets are bolted. The armature shafts are carried in ball bearings. The resistance of each armature hot is 0·048 ohm, and when the three armatures are mesh-coupled they can deal with a slip-ring current up to 120 amperes. The current in each armature is then 70 amperes, and the ohmic loss in the winding 3·35 volts, to which must be added the loss by contact resistance of the brushes. This is small, since it is possible to use copper-carbon brushes. There is no sparking. When the current has crest value the armature is at rest, and when the armature has maximum speed and the frequency of commutation has maximum value the current is zero. At intermediate points there is some reactance voltage of commutation, but this is extremely small—only a fraction of a volt. The armature is 4½ in. in diameter and its core 8¼ in. long. The vibrator was tested with a 60-H.P. Hunt cascade motor having six pairs of tappings. As the vibrator has only three armatures it could only deal with half the secondary circuit of the motor. The improvement in power factor was nevertheless very marked. The power factor was raised at half-load from 0·72 to 0·91, and at full load from 0·81 to 0·93.

The author is not able to give results from actual practice with a vibrator fitted to a large motor, because a small vibrator made by the Sandycroft Foundry Co. for the 60-H.P. Hunt cascade motor is as yet the only representative of this type of machine in this country. A Continental firm is making one for a 450-H.P. motor, but it has not yet been finished. The author has, however, made a design for a vibrator to be applied to the 800-H.P. motor of which particulars were given in Prof. Miles Walker's paper, and he finds that each of the three armatures would be 13 cm. in diameter and the length of core 33 cm. The armature resistance would be 7·2/1,000 ohms, and a flux $\phi = 3{\cdot}45$ megalines would be obtained with a magnetomotive force of 6,700 ampere-turns. At full load the injected E.M.F. is 23 volts. The excitation requires an expenditure of 700 watts, and the losses in the copper and iron, in brush friction, and in contact resistance, come to 1,300 watts, making a total expenditure of 2 KW. for the vibrator, against which must be set the reduction of losses in the motor due to the better power factor.

Fig. 5 gives the predetermined power-factor curve. The power factor of the 800-H.P. motor would with this vibrator be brought to unity at one-quarter load; at half load it would be 0·9 with a leading current; at full load it would be 0·95 with a leading current; and at twice full load it would again be unity. Above this output the current lags with a power factor of 0·92 at treble load, when the limit of stability is approached. The weight of the vibrator is, as near as can be estimated, 18 cwt., and the floor space occupied is 18 in. by 3 ft., the vibrator standing 3 ft. high.

Whether a rotary or a vibrating machine be used as a phase advancer, the power to drive it is in either case very small, and will generally be more than covered by the reduced losses in the motor. The efficiency of any given motor, whether it works with or without a phase advancer, will therefore not be appreciably altered. There may, however, be a gain in the yearly energy efficiency, as the use of a phase advancer enables one to do with a smaller motor, since the overload capacity is increased. A smaller motor has smaller

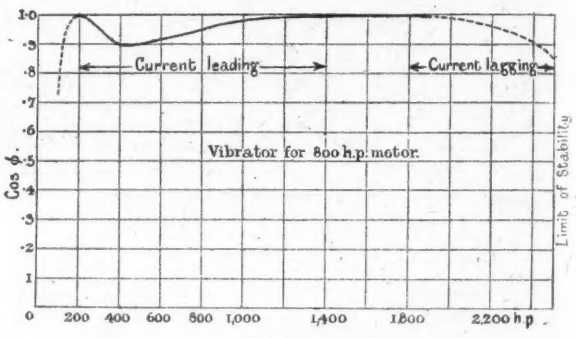


FIG. 5.

losses, and consequently the customer of a power company using his motors with a phase advancer attached will effect a certain saving in his bill for current even if the power company does not grant a special discount for his taking current at a high power factor.

Now how does the case stand with the power company? The cost for electrical energy generated and transmitted is made up of several parts, of which, however, only two need here be considered. One is the actual cost of generation, including a certain percentage of loss in transmission, and the other is independent of the amount of energy generated, but depends only on the cost of the plant which must be installed to provide the service. Part of the plant, such as the prime-movers, is only very slightly affected by the power factor; but the electrical plant, including the line and step-down transformers at the customer's end, is materially affected by it. The cost of the electrical plant is determined not by the true power, but by the output defined in volt-amperes; consequently it is only fair that a customer who takes his power adulterated by a large proportion of sin ϕ should in his payment for current recompense the company for the extra plant capacity necessary for the generation and transmission of wattless current. The customer should therefore not only pay for the true kilowatt-hours he takes but also something for the K.V.A.-hours.

This reasoning is the basis of a system of metering invented by Prof. R. Arno, of Milan. He and Signor Conti, the engineer to several Italian power companies, investigated the cost of generation and transmission as affected by power factor, and they found that the cost may with sufficient accuracy for practical work be taken as proportional to the sum of two-thirds of the watt-hours plus one-third of the volt-ampere-hours. Having settled this as a basis for charging Prof. Arno set to work to design a meter which would register according to this formula; and he has also indicated a way in which any meter may be adapted to register two-thirds of the watt-hours and one-third of the volt-ampere-hours.

In meters of the electrodynamic type where the moving system is a little armature traversed by a current in phase with the E.M.F. and the field is produced by the main current, a small lag is given to the armature current. In meters of the induction type where the moving system is a disk revolving under the combined influence of a shunt and main field, a small lag beyond 90° is given to the shunt field. The angle of lag in either case is so chosen that at the predominant power factor the meter registers according to Prof. Arno's formula. Thus for installations mainly supplying light the lag of the shunt current behind the E.M.F. is 5° in dynamometric meters and 95° in induction meters. The meter will then register with a negligible error at any power factor between 1 and 0·85. For installations consisting mainly of motors, the lag is 14° for electrodynamic and 104° for induction meters. The extra lag of 14° may be produced by a slight alteration in the compensating coil of the shunt field.

Prof. Arno states that meters so adjusted may be used in cases where the power factor varies from 0·5 to 0·9. For large consumers where great accuracy in the metering is essential, two meters side by side may be installed, one registering kilowatt-hours and the other K.V.A.-hours. The charge to be made to the consumer can then be calculated on the two-thirds and one-third basis, or on any other basis which may more nearly fit the special conditions of the power company's plant.

It is of interest to inquire what saving a customer may effect in his current bill if he uses a phase advancer. Take a large customer using large and small motors with an aggregate power of 1,000 KW. and a power factor of 0·75. Since only the large motors can be fitted with phase advancers, it will scarcely be possible to raise the power factor to unity, but a value of 0·95 may be obtained if large motors aggregating 700 to 800 KW. are so fitted. With a load factor of 34 to 35 per cent., the yearly consumption will be 3,000,000 KW.-hours.

With 0·75 power factor, the Arno meter would register 3½ million units; but after fitting phase advancers, the meter would register only 3·053 million units. With current at 0·5d. per unit this makes a difference of about £600 in the bill for current.

This, or something approaching this figure, represents the saving to the power company, owing to their having to supply very little wattless current. If, then, this saving is divided between the company and the consumer the latter gets £300 as a return for his capital outlay on phase advancers. To provide such apparatus for motors aggregating 800 KW. would cost between £300 and £400, so that the phase advancers would prove an excellent investment for the customer, and be still more profitable to the company. The latter not only reduce their working expenses by £300 a year, but they also may increase their sale of current by taking on more consumers to the extent to which their plant has been liberated from wattless current.

Clauses for Street Lighting Specifications.

THE CHAIRMAN (Mr. F. W. Goodenough) opened the resumed discussion on Mr. A. P. Trotter's paper before the ILLUMINATING ENGINEERING SOCIETY, on April 29th. He said that in his opinion, a specification on which street lighting tenders were to be invited should be:—(1) Framed on a basis easily comprehensible by members of local authorities; (2) Based on a standard intelligible to the average man in the street; (3) Of quite general application; (4) Not open to any interpretation which, while complying with the specification, gave absurd lighting; (5) Definite. Nothing should be left to the discretion of the contractor. It should be possible to open tenders, and at once classify their data for comparison. There should be no question as to whether arrangement A or B suggested by different contrators was the better, otherwise the whole idea of the specification was defeated; (6) The provisions for making the tests upon which the contractor was to be liable to penalty for deficient lighting should secure a reasonable accuracy of result and the method of testing should be specified closely. The speaker maintained that no average councillor could understand such a term as "0·025 minimum horizontal foot-candles," but most persons had a tolerably accurate idea as to the relative value of lamps of various candle-powers. Candle-power specification was contemplated by the present specification for 80 per cent. of the streets and roads in the country, and, in his opinion, the procedure in all cases would be to determine how many lamps, of various candle-powers, arranged at various heights and distances apart, would light adequately various classes of streets and then specify on this basis. Local authorities wished to obtain *effect*, but they must really buy the cause thereof and this should be specified. Were the candle-power of lamps and the height and distance of posts not specified, requirements (4) and (5) would probably not be satisfied. It was a mistake to ignore all but the minimum illumination; Mr. Edgcumbe six years ago said that minimum illumination was a scientific criterion, but æsthetic results had also to be taken into consideration, and high average was desirable even though the lighting was not very uniform. What was wanted was a bright and pleasing street appearance; obvious facts and considerations were ignored by the "scientific" basis adopted by the specification. In support of his arguments, the speaker quoted communications received from various foreign correspondents.

He considered that no one closely acquainted with street lighting photometry would be willing to accept a margin of less than 25 per cent. to provide against errors of observation and local disturbing influences in taking low minimum illumination reading. Apart from errors of observation, there would be a possibility of over 20 per cent. discrepancy if the alternative method of computation, by adding horizontal components, were employed. Authorities must be prepared to allow a margin of 33 per cent. from the contract minimum, or contractors must provide that excess to guard against possible penalties. Quoting Dr. Louis Bell—in a street lighting contract involving £50,000 or £100,000 per annum, a difference of 2 or 3 or 5 per cent. in the measured illumination was a very serious matter, and dependence upon measurements known to vary within at least this range would simply lead to exasperating litigation. The speaker submitted that the draft specification failed in every essential point to meet the requirements of a standard specification for street lighting. To produce a specification of real practical value with a truly scientific basis, the Joint Committee should abandon the "Unit of Measurement" clause and substitute one providing for rated candle-power of lamps determined by direct readings at specified angles, in a specified direction, with a specified relationship between readings at the widest and narrowest angles; and should provide a schedule showing by what number and arrangement, height, spacing and placing of lamps of specified candle-power, the illumination of streets in various classes could be (because it had been) obtained. A practical, equitable, comprehensible and comprehensive specification would be welcomed by all suppliers as well as all users of illumination.

PROF. J. T. MORRIS explained that he had placed all his test data before the Committee, but there had been no time to check those readings, which showed the discrepancies to which reference had been made by various speakers. In order of descending illumination:—In streets having minimum horizontal illuminations of 0·030; 0·023; 0·021; and 0·017 ft.-candles; the discrepancies between the sum of calculated minimum horizontal illuminations and measured values of the actual minimum horizontal illumination were:—3 per cent.; < 1 per cent.; 9 per cent.; and 20 per cent., but the absolute discrepancies were only:—0,001; < 0·001; 0·0015; 0·004 ft.-candle. The lower the illumination, the greater the absolute discrepancy, hence the percentage discrepancy rose rapidly but, provided the horizontal illumination was not less than 0·02 ft.-candle, the difference between measured and calculated values was not greater than 0·0015 ft.-candle, and improvements in photometers would probably produce yet better agreement in future. Foreign illuminating engineers of high repute seemed to be against the adoption of minimum horizontal illumination as a sole basis of specification. Could they not adopt the minimum in conjunction with either the average horizontal illumination or the mean hemispherical candle-power of the lamps used? Just as the uniformity of illumination in the I.E.E. theatre was depressing, so would be uniform minimum horizontal illumination along a street. The specification as it stood would encourage uniformly low street illumination, and some such modification as that suggested appeared desirable.

MR. J. W. BRADLEY (city engineer, Westminster, communicated): As one who had controlled street lighting specification and contract work for many years on a C.P. basis, and had had much experience in surface illumination measurements, the writer preferred candle-power as a basis of specification. The C.P., height and general polar distribution of lamps should be specified, and the engineer should reserve control over the lantern and globes, &c. The contractor had then a definite basis on which to work. Specification by minimum illumination would involve the contractor in difficult problems. It was desirable that as few lamp-posts as possible be used, considering the obstruction they offered to the public, and, in important streets, a sufficient vertical depth must be adequately illuminated. The approximate number of lamps ought to be specified, and tenders should quote a price per position for each class of lamp. The location of standards must be entirely in the hands of the engineer; there were innumerable factors governing the position in which posts should be erected, and were a contractor allowed to place lamps where he would, so long as he illuminated to a satisfactory degree a plane 3 ft. 3 in. above street level, endless disputes would be raised between ratepayers, local authorities and contractors. The writer believed he was the first to specify in a lighting contract a definite amount of measured light as a basis for tendering, and after many years' experience of public street illumination, carried out under contracts based on the measurements of direct C.P., and with the knowledge of the working of such contracts in respect of both gas and electric lighting, he could definitely state that these contracts had proved satisfactory in every way; they had lapsed, and been again re-entered upon by the previous contracting parties—a fact which testified to their fairness and ease of working. The principal points in this specification were:—5s. penalty per day per lamp of deficient C.P.; lamps to be not less than 22 ft. (large units) or 12 ft. (small units) from the ground level; each lamp to give at least 90, 180, 1,800 or 3,000 C.P. as directly measured by an approved photometer placed at ground level, the C.P. being arrived at by averaging two readings in any position with regard to the light under test (readings at 20° and 50° to horizontal); light to be steady white or yellowish-white; the design of lamp pillar, winding gear, reflectors, &c., to be approved by the city engineer; the onus of testing (for maintenance purposes) to lie with the contractor.

MR. FRANK BAILEY declared himself a strong supporter of the specification. Appendix A offered an alternative to those who disagree with a minimum horizontal illumination specification, and too little attention had been paid to this section in reading and discussing the paper. Many of the objections raised by gas engineers indicated insufficient acquaintance with the object and scope of Appendix A.

MR. E. ALLAN (Vice-President, Institution of Gas Engineers) said there could be no doubt that the minimum horizontal illumination in Bow Street (lighted by high-slung centre suspended arcs), was good, but the general lighting effect was very poor. A specification was wanted which should be suitable for all undertakings, and he suggested that some other basis of comparison than minimum horizontal illumination should be added.

MR. ROGER SMITH pointed out that there were two distinct types of specification: that adopted by architects and constructional engineers, in which every detail of the work required was fully specified, and the whole responsibility of results lay with the designing engineer—and that by which general machinery was often specified—the desired result being stated, and the means and obtaining of this result being left with the contractor. There were various types of specification between these extremes, but it seemed to him that to specify all the details of the plant and the result to be secured violated every canon on which a specification should be based. When details of equipment were specified, a certain result might be expected, but must not be specified. The Joint Committee had chosen to follow the second alternative, and trust the contractor to select the means of securing a specified result; apparently gas engineers were not prepared to place such trust in contractors. During the past seven years he had designed all his railway lighting installations on the basis of minimum horizontal illumination 4 ft. from the ground, and in future his plane of measurement would be 1 m. from the ground. Under the conditions of his work speed was all-important, and he believed that specification of minimum horizontal illumination resulted in a great saving of time. The horizontal was the only plane on which a good criterion could be obtained by a single measurement, the results of which took in those on other planes of reference by implication. If one result alone was to be specified, that must be horizontal illumination. In street lighting the contractor was justified in taking advantage of light received by reflection, and from other lamps; account could only be taken of these components by horizontal illumination measurements. A certain maximum horizontal illumination (with plus and minus limits), should be specified in addition to the minimum horizontal illumi-

nation, and some restriction should be placed on the intrinsic brilliancy of the luminous source; at present, much of the powerful lighting in London streets was positively dangerous.

Mr. Cooper said that many of the objections to the specification rested on misconceptions. Horizontal illumination could be measured accurately, and if it was adequate the illumination of other planes was in practice satisfactory; illumination limits were first reached on the horizontal plane. In his opinion, the average town councillor knew no more about candle-power than about foot-candles; actually there was no reason why he should be familiar with either. Specification by candle-power was difficult in cases where dioptric or other special globes or reflectors were used; in case of very powerful units; and in cases where a number of lamps were mounted in separate globes carried by radiating arms on one post (as in "White Way" lighting units). Minimum horizontal illumination measurements offered no real difficulties and took account of every factor concerned. Glare had not been dealt with in the specification. The lighting in a street might be raised from Class A to Class E by simply increasing the candle-power of the lamps tenfold, but then glare would probably be serious, and the specification ought to discriminate between such and legitimate practice. In his opinion, it was the illumination on the street level which was of importance; not only was this illumination higher, and hence easier to measure than that on the metre plane, but also the latter penalised lighting systems in which low posts were employed. No specification should be adopted which systematically penalised any particular lighting system without cause.

Mr. Abady considered that the specification was wrong from end to end; that it bristled with inconsistencies, was far removed from anything likely to be of use to anybody, and was unworthy of serious discussion. The minimum horizontal illumination basis was admitted to be inapplicable to 80 per cent. of the streets in the country, and the estimation of horizontal illumination by summation of calculated components did not even approximately agree with the actual horizontal illumination. The specification of a minimum illumination connoted a search for the minimum—a tedious operation, and one leaving much to the discretion of the photometrist. Minimum illumination was not a basis of comparison and minimum horizontal illumination was the nadir of inutility. To make tests 3 ft. 3 in. above ground level was not fair to lamps on low posts. Horizontal illumination, whether minimum or maximum, was useless as a basis of comparison between systems, but if it was to be considered at all, it must be that on the street surface. Lighting problems could not be dissociated from the source itself or from the surface illuminated. Everything was seen by reflected light, and the amount of the latter depended on the nature of the surface as much as on the lamps lighting it. In the cases mentioned by Mr. Cooper, in which candle-power was difficult of specification, there was no difficulty in measuring the normal illumination received in a certain direction—the conversion of this normal illumination to candle-power was a purely arithmetical operation. The speaker supported Mr. Goodenough's suggestions. Local authorities did not want to buy minimum horizontal illumination. The specification permitted 2° error in the determination of the angle of incidence of a direct ray; this might lead to 20 per cent. error in the results in certain cases. The range of illumination in the street "classes" was too great; a 50 per cent. variation of illumination in one direction might leave a street in the same class, while a few per cent. change in the other direction would alter its classification.

Mr. J. S. Dow outlined the views and arguments expressed in communications received from a number of members abroad:—

Dr. L. Bloch (Berlin) agreed with horizontal plane measurements, but preferred average to minimum illumination as a basis for specification. Were minimum illumination the sole consideration, electric lighting would be in a particularly favourable position. At least, the mean and maximum horizontal illuminations should be specified in addition to the minimum.

Dr. L. J. Terneden (Amsterdam) wrote that in addition to horizontal-plane measurements, the minimum illumination should be determined in a vertical plane perpendicular to the direction of street traffic.

Dr. H. Strache (Vienna) wrote that horizontal illumination alone was not a sufficient basis of specification.

Prof. S. A. Rumi approved of Mr. Trotter's suggestions; in Italy contracts usually referred to candle-power rather than to illumination.

Dr. L. Bell (Boston, U.S.A.) thought that the suggestions for the draft specification of a standard contract were sufficient to secure good results. For most purposes measurements of illumination on a vertical plane would give a better indication of the practical value of an illumination scheme than would horizontal plane measurements.

Mr. L. B. Marks (New York) said that minimum illumination was an insufficient basis of specification. Intrinsic brightness was often a matter of prime and determining importance.

Dr. C. H. Sharp (New York) said that in streets to be illuminated brightly at all points, specification of the minimum should ensure good illumination, though it might not compare correctly different systems. In the majority of streets, however, specification of minimum illumination or the C.P. at 10° below the horizontal furnished an insufficient criterion. The delivery of a sufficient flux of light and its proper distribution might be ensured respectively by specifying the average and minimum illumination over the area. The flux-of-light method of computing average illumination was being used very generally and offered no special experimental difficulties. The illumination measured should be that on the street surface.

Mr. P. S. Millar (New York) considered minimum intensity an unsatisfactory basis of rating for a street lighting system. The real value of a scheme depended on the maximum and perhaps the average as well as the minimum illumination.

Mr. L. Gaster said that the irreconcilable opposition of the Gas Members of the Joint Committee had led to the arrangement of the present discussion, and it was and had been throughout intended that, after the discussion, the draft should be taken back into committee for amendment or amplification. He did not think it necessary to impose rigid penalty clauses; there were other means whereby the interests of the public were fully safeguarded.

In his reply, Mr. A. P. Trotter spoke of the unique constitution of the Joint Committee. As the representatives of the several institutions were unanimous among themselves, and as voting had been by institutions, no injustice seemed to have been done. The matter to be discussed was not methods of street lighting but a means of describing it when obtained. In his opinion, the specification afforded a very practical solution to this problem. Some of the participants in the discussion must have stopped reading the paper before they arrived at the specification. In practice no survey was required to locate the point of minimum horizontal illumination; it could almost be located by eye—only a few confirmatory observations were needed. He attached the utmost importance to the agreement between the surveyors' classification and that reached by the minimum horizontal illumination measurements. The surveyors must have allowed for reflected light from house-fronts and for the value of direct ray illumination at crossings; but the fact remained, simple horizontal illumination measurements led to the same classification. Admittedly, direct ray illumination was and horizontal illumination was not of importance in street lighting; yet, so early as 1883, Sir Wm. Preece had recognised that horizontal illumination was the quantity to measure—not because it was most useful, but because it allowed of an accurate description of the lighting with minimum trouble. Even were direct-ray measurements made, it was only necessary to use a table of cosines to reduce the results to the horizontal plane for comparison. He was willing to add a direct-ray clause to the specification if it could be shown how comparisons were to be effected and how direct-ray illuminations were to be added. Direct-ray was greater than horizontal illumination and was easier to measure in this respect, but the horizontal was the only plane on which all illumination was added automatically. There seemed to be no reason why a Town Council should understand foot-candles or C.P.; all they need do was to ask for light similar to that in such and such a street. The specification was intended to aid technical men ordering and providing illumination. The approximate height and location of lamps must always be determined by the surveyor, but the details of illuminating schemes should be left to the contractor, otherwise the responsibilities of borough surveyors would be enormously enhanced, and progress in good lighting would be seriously retarded. For instance, the keen competition between gas and electricity had undoubtedly led to more rapid and extensive improvement than would otherwise have been attained in lighting. The absurdities feared by some of the gentlemen who had spoken would not be realised; for instance, the cost of abnormally tall posts would prevent their adoption. The cost of the only lighting units which could provide it would prevent dismal "flat" illumination. Mr. Harrison's table was based on a formula, and should not be used outside the limits demarcated by the horizontal lines shown in the various columns. Sec. 8 had been specially inserted to provide a safeguard in respect of "glare." By simply specifying minimum illumination, the purchaser inevitably received a bonus of light. The draft specification contained certain illumination clauses, but much of it was intended for candle-power work. Dr. Bunter had shown it to be possible to make accurate measurements of very low horizontal illumination. Only in extreme cases were candle-power measurements imperative; for the latter the specification made full provision, though it was primarily intended for those cases in which good lighting was desired. Frankly, he shirked the calculations involved by average illumination specifications. Mr. Bradley's views deserved careful consideration, but it should be remembered that a system which proved admirable in a certain district with which a surveyor had grown thoroughly familiar by long association might prove quite unsatisfactory for general use; the Committee certainly aspired to the formulation of a specification suitable for international use.

In a letter addressed to us, Mr. Kenelm Edgcumbe says that as he had already spoken in the discussion on Mr. Trotter's paper when Mr. Goodenough alluded to some opinions expressed by him six years ago, he had no opportunity of replying. Mr. Goodenough appeared to think that because Mr. Edgcumbe was now in favour of the proposed draft specification, he had changed the views he held in 1907. Nothing could be further from being the case. He was then, and was still, absolutely convinced that the horizontal illumination was the only satisfactory criterion of street lighting.

The point which Mr. Goodenough seemed anxious to make was that in 1907 Mr. Edgcumbe held that it was the average horizontal illumination which counted, whereas, in 1913, he was found to be in agreement with a specification which took the minimum horizontal illumination as the criterion. He was still strongly of opinion that the average illumination was of importance. At the same time, he was not in favour of making a statement of either the maximum or average obligatory in a street-lighting specification, and this for the following reasons:—

1. The measurement of the average illumination over a given area is a matter involving a large amount of work—certainly much more than could possibly be devoted to it by the engineer in supervising the execution of a lighting contract.

2. To specify the maximum illumination is open to the very

serious objection that "freak" spots would have to be guarded against.

3. Most important of all, experience has shown, as is made abundantly clear by Mr. Trotter in his paper, that the minimum illumination does, under present conditions of lighting, give a criterion which is in entire accord with that made by eye by experienced judges.

With regard to Mr. Goodenough's query as to his opinion of a "dismally lighted street" as compared with a "brightly lighted one," it was entirely a question of the amount of money which the purchaser was prepared to spend, seeing that Clauses 7 and 8 of the proposed specification gave the engineer complete control in this respect.

He would like finally to bring Clauses 5 and 11, as well as those just cited, to the notice of Mr. Goodenough and the other speakers, who seemed to have derived so much exhilaration from the mental gymnastics involved in working out all the possible and impossible combinations of height, spacing and candle-power, giving the same horizontal illumination.

If the infinite number of such combinations, all giving the same result, meant anything at all, surely it was that it was better to specify the result rather than the ingredients which went to make it up, more especially since the capabilities of one of the chief ingredients, namely, the lamp, could not possibly be so well known to the purchaser as to the supplier.

BIRMINGHAM'S PROPOSED NEW POWER STATION.

AN interesting report is that which was presented by the Birmingham Electric Supply Committee at the quarterly meeting of the City Council on Tuesday last, on the question of the proposed new power station at Nechells. From it we gather that sanction to the purchase of land and to the sum of £500,000 being raised for the scheme was given by the Council in 1911, and approved in the Corporation Act of 1912. The city is at present supplied from three generating stations :—

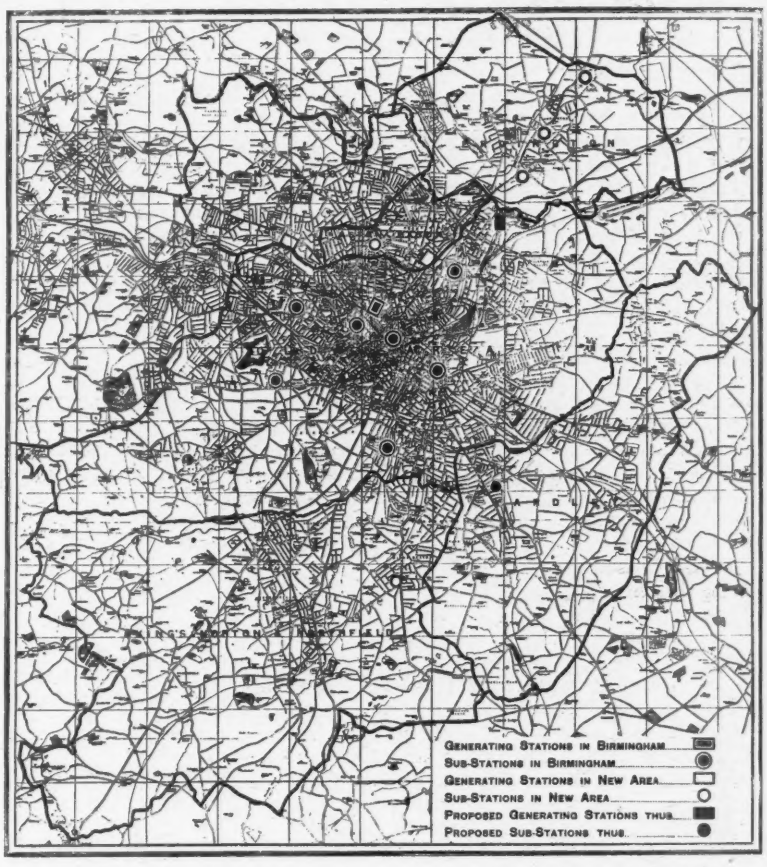
Summer Lane ...	Capacity 25,500 KW.
Water Street ...	Capacity 3,040 KW.
Chester Street, Aston Manor	Capacity 4,550 KW.
Total	33,090 KW.

The capacity of the Summer Lane Station, as originally designed, was 22,000 KW., but as advantage has been taken of the developments in generating machinery since that date, and more land has become available, the ultimate capacity of this station will be increased next year to 36,500 KW., and contracts for the final instalment of plant up to this capacity have recently been placed. Although it would be possible to substitute larger generating plant in place of that already installed in the engine house, there is no room for the necessary corresponding increase in the boiler equipment.

While it is intended to continue to supply from the Water Street station during the winter months, any increase of the plant there is out of the question.

The Aston Manor station has reached the limit of its present capacity, and the difficulties in the way of increasing the generating plant are considerable; it will consequently be more economical to supply any further demand in the area served by this station from Summer Lane, or from the Nechells power house. To ensure continuity of supply in case of breakdown there should be a margin of 20 per cent. of spare plant, and it will be seen from the table on the next page that it is necessary to make further provision by the winter of 1915-16.

The Nechells power house will supply current at 5,000 volts, 25 cycles, to the whole of the area of the greater city, *via* Summer Lane or the sub-stations, and also direct to high-tension consumers.



THE "GREATER BIRMINGHAM" AREA, SHOWING THE EXISTING AND PROPOSED GENERATING AND SUB-STATIONS.

The ultimate capacity of the station will be 100,000 KW., the first portion being designed to accommodate plant of 25,000 KW. capacity. It is proposed to install 15,000 KW., of which two-thirds will be available by the winter of 1915-16.

A private canal basin will be provided, only a portion of which will be first constructed. A railway siding will also be built, and this will be employed for conveying material and machinery to the site, and for subsequently dealing with a portion of the coal and ash traffic.

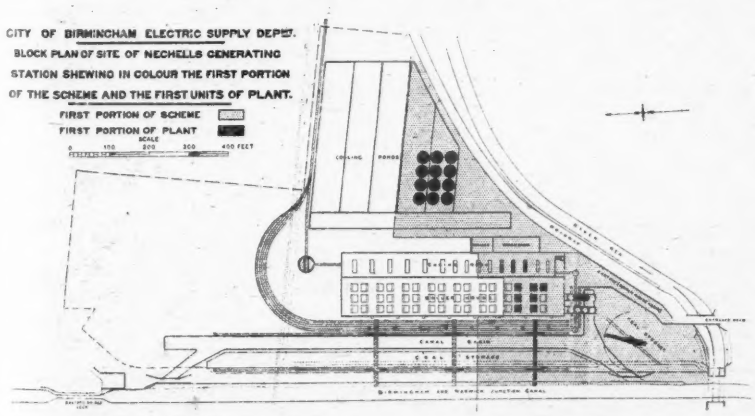
The main coal store will be in the open on the wharf, and there will also be an auxiliary coal store on a piece of vacant land adjoining the entrance to the site. The total capacity of these coal stores is 10,000 tons of coal. For the ultimate capacity of the station there is further space available for coal storage purposes capable of accommodating 50,000 tons.

The coal will be handled by means of transporter cranes, which can be used for the double purpose of filling or emptying the stores, and for feeding the conveyors which will be used to supply the coal bunkers over the boilers. These conveyors may also be fed from railway trucks which can tip the coal direct into them.

It is proposed to install at the outset three 5,000-KW. turbines. Later on a larger type, probably of 10,000 KW., will be installed. An overhead electrically-driven crane, capable of lifting a maximum weight of 60 tons, will be provided.

In the boiler house, marine type water-tube boilers, fitted with superheaters and overhead economisers, will be erected. It is proposed to use short iron chimneys, and to control the draught by means of motor-driven fans on the Prat system. Seven boilers will form the first equipment to provide steam for the three generating sets.

For removing the ashes from the boilers it is proposed to adopt a


CITY OF BIRMINGHAM ELECTRIC SUPPLY DEPT.
BLOCK PLAN OF SITE OF NECHELLS GENERATING STATION SHEWING IN COLOUR THE FIRST PORTION OF THE SCHEME AND THE FIRST UNITS OF PLANT.
FIRST PORTION OF SCHEME
FIRST PORTION OF PLANT
SCALE
0 100 200 300 400 FEET
LOADING PONDS
CANAL BASIN
COAL STORAGE

THE PROPOSED NECHELLS POWER STATION, BIRMINGHAM.

new system operated by air suction. Large totally enclosed ash receiver drums are installed, from which the air is exhausted by motor-driven exhausters. The drums are connected to pipes which run under the ashpits beneath the boilers, and a rush of air is thus continually maintained through these pipes. The ashes are dropped out of the ashpits into a small movable crusher, thence through openings into the pipes, and drawn by the rush of air into the receiver drums. The latter are emptied into barges, carts, or railway wagons. The basement of the boiler house is in this way kept quite free of all dust and from the corrosive fumes given off from the ashes when slaked.

Year.	Plant capacity of all stations in KW.	Maximum demand in KW.	Spare plant available, KW.	Percentage of plant capacity.
1909-10	20,540	15,260	5,280	25·7 %
1910-11	22,040	17,156	4,884	22·2 %
1911-12	*28,590	24,081	4,509	15·7 %
1912-13	33,090	27,775	5,315	16·06 %
1913-14	39,090	†32,950	†6,140	†15·7 %
1914-15	44,090	37,450	6,640	15·06 %
1915-16	‡44,090	43,150	940	2·1 %
1915-16	§54,090	43,150	10,940	20·2 %

* From 1911-12 Aston Manor is included.
† The figures in cols. 3, 4 and 5 are estimated for 1913 14 and onwards.
‡ Without Nechells.
§ With Nechells.

A switch house will be constructed over the entrance cartway to accommodate the whole of the switchgear required for controlling the generating plant, the out-going feeder cables and the various lighting and power circuits within the station.

on hire at date is 894, and the horse-power 5,749. The total expenditure on this account to date is £23,070.

The units sold for L.T. power for the 12 months ended March 31st, 1906, when the scheme was sanctioned, and the units sold during the 12 months ended March 31st, 1913, were as under :—

	Units.	Revenue.
Twelve months ended March 31st, 1906	1,490,506	£10,266
Twelve months ended March 31st, 1913	17,626,743	£70,427

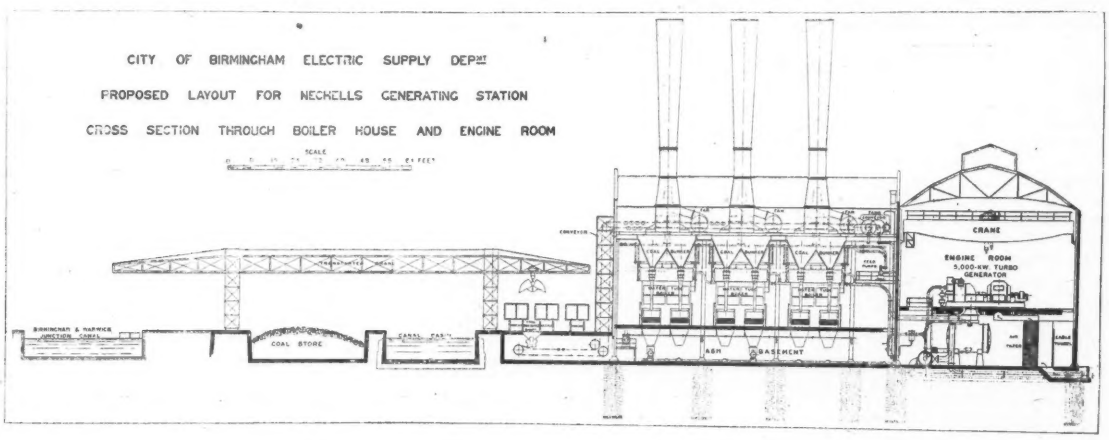
The Committee considers it desirable to continue the scheme on its present lines, and recommends the borrowing of the sum of £20,000 to cover the expenditure in excess of the original loan and prospective expenditure on the same account.

Loan for Service Connections, Extra-High-Tension Switchgear, and Transformers on Consumers' Premises.—In 1909, the Council sanctioned a loan of £149,350 for the general purposes of the electric supply undertaking ; this included a sum of £23,000 for services, high-tension consumers' switchgear, and transformers on consumers' premises. The expenditure against this loan to date is £29,996.

The following table shows the increase in the number of consumers and in the output of electricity since the date mentioned above :—

	March 31st, 1909.	March 31st, 1913.
Number of consumers	3,903	7,435
Units sold for low-tension lighting and power	10,796,024	25,288,679
Units sold for high-tension power ...	1,827,794	16,908,474
Total units sold...	12,623,818	42,197,153

It is proposed to borrow a further sum of £30,000 to cover excess and future expenditure under this head.



The Proposed Nechells Power Station, Birmingham.

Workshops, offices and stores will also be provided adjoining the engine house.

Large cooling ponds will be arranged on the vacant land adjoining the engine house, divided up into sections, so that any section can be emptied for cleaning purposes. Over these ponds will be installed cooling towers for cooling the whole of the circulating water required in the station. It is proposed to use the effluent water from the filter beds of the Birmingham, Tame and Rea District Drainage Board for circulating in the condensers, and an ample quantity is available on the site. A first instalment of 12 cooling towers will be sufficient for the initial requirements of the station.

The Committee states that it is satisfied that at present and for some time to come, turbine plant is the best that can be adopted ; this decision has been arrived at after examining proposals for gas-driven plants by home and foreign makers.

The Committee unanimously asked the Council to approve the plans and estimates presented. The latter include the following sums :—

Nechells, land and buildings	£132,500
,, plant and machinery	156,000
Sub-station equipment	50,000
Underground mains	161,500
	£500,000

A loan for sub-station equipments of £11,300 was sanctioned by the L.G.B. in January, 1911. This has been expended, as well as an additional £5,380 included in the sum estimated above to cover a period of five years. The last mains loan, amounting to £94,000 (in 1909), has been expended, as well as £46,546 additional, included in the amount mentioned above, which will meet the cost of trunk cables and ordinary requirements for two years.

Loan for Provision of Motors for Hire and Hire-Purchase.—In 1906, Council sanctioned a scheme for supplying motors upon hire and hire-purchase terms, and a loan of £20,000 was authorised. The scheme has been widely adopted ; the total number of motors

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

The "Lynton" Radiator.

This radiator has been designed by Mr. Lynton of the Charing Cross and City Electricity Supply Co., especially for hiring out purposes. We understand that one of the chief difficulties of supply companies in this direction is the cost of maintenance.

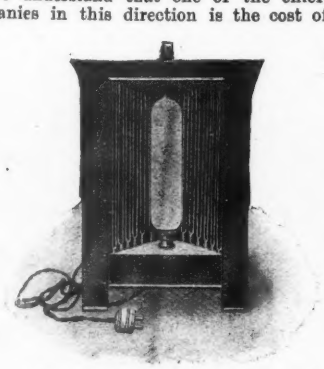


Fig. 1.—"Lynton" Radiator.

This point has been carefully studied in the radiator illustrated ; all repairs, should they be necessary, can be done on the spot by the company's workman, and there is no need for the radiator to be returned to the workshop.

Only one lamp is fitted in the front of the radiator, and this is claimed, by the special arrangement of the reflectors, to give almost the effect of two. Messrs. Veritys, Ltd., of King Street, W.C., have the sole rights of manufacture of the "Lynton" radiator, and they will be pleased to forward a sample to any engineer who is interested. The heating elements at the back have a special arrangement for affixing the company's seal to prevent tampering.

The "Tress" Illuminated Signs.

We recently visited the offices of the Tress Co., 4, Bathbone Place, W., to examine their electrically illuminated signs, of which they make a great variety, as well as a wide range of fittings, apparatus and accessories for cinematograph theatres, photographers and other trades. In addition to illuminated letter signs, transparencies, &c., of the familiar types, the company are just introducing a novel sign, which is totally different to any that we have yet seen, and is extremely effective. The accompanying illustration shows one of these devices in the form of a double-sided hanging sign, which to all outward appearance is like others of its kind; when in operation, however, the large illuminated letters gradually diminish in size, keeping their correct proportions and constant spacing, until they finally disappear altogether; they then

Fig. 2.—"Tress" Contracting and Expanding Letter Sign.

reappear on a diminutive scale, and gradually regain their maximum dimensions, when the cycle is repeated. The effect is exceedingly striking, and inexplicable to the uninitiated observer; it is obtained by an ingenious device on the same principle as the iris diaphragm, but it is impossible to detect the method of operation. The letters and background may be of any colours in strong contrast, and are effective by day as well as when they are illuminated. The mechanism is driven either by clockwork or by a small motor, taking a trifling amount of power. The sign has been eagerly welcomed by contractors and others. The company will retain the manufacture in their own hands, supplying only to the trade. There is, of course, no limit to the variety of patterns in which the sign can be made, including interchangeable letter signs.

Apart from signs, the Tress Co. do a very extensive business with the trade in seats, programme boards, arc lamps and rheostats of their own make, a ticket-issuing machine with an electric tell-tale, and electrical and photographic supplies in general.

An Electric Staff-Kitchen.

Some three months ago the Simplex Co. equipped, in connection with their office staff dining club in Birmingham, an electrically-operated kitchen. The time is yet early to have secured any very

Fig. 3.—Simplex Electric Kitchen.

exhaustive figures as to cost, but the experience gained is proving exceedingly useful, and clearly demonstrating that electric cooking can more than hold its own from every point of view. Some 40 meals are prepared per day, consisting of soup, at least two kinds of joints, a choice of sweets, coffee, &c., and, in addition, some 60 teas per day, many of which are of the variety known in certain localities as "high."

The records of cost so far secured may be regarded as distinctly satisfactory, in view of the fact that they include the heating of all the "washing-up" water (no small item), and that the cook has had no previous experience of the electrical method, and has yet to remember that a switch is designed for cutting off the current when it is not wanted. The average cost per person per meal has proved to be a fraction over ½d., with current at 1d. per unit.

The kitchen is being used to test articles of standard manufacture in actual practice, rather than to obtain results from the use of a large elaborate cooking range.

So far, there has been complete freedom from breakdown of the actual elements, the only mishap being a broken connection to the grill on a cast-iron oven. A view of the kitchen is given in fig. 3.

PARLIAMENTARY.

Rhondda Tramways (Railless Traction) Bill.

Sir Ivor Herbert's Select Committee of the House of Commons last week and this week considered the Bill promoted by the Rhondda Tramways Co. for power to construct about 5 miles of railless trolleys, to start from their existing tramways and go through the parish of Llantrisant. Mr. Vesey Knox, K.C., and Mr. Tyldesley Jones represented the promoters, and Mr. Hutchinson, K.C, and Mr. Rhys Williams were for the Llantrisant Rural District Council, who opposed.

Mr. Vesey Knox, K.C., in opening, stated that the tramway company had spent about £390,000 on their tramways, and in comparison with that the railless traction scheme was a very small undertaking, for it was estimated to cost only £20,000. If the powers sought were granted, it was proposed to give a half-hourly service, with a maximum fare of 5d. and a minimum fare of 1d. The roads were suitable for such a service, and would require no widening, but if the Committee came to the conclusion that the company ought to contribute to the upkeep of the roads, then he asked that such contribution should not exceed ½d. per car-mile.

Mr. Watts Morgan, agent for the Rhondda district of miners, stated that 40 federation lodges in the district, representing 38,000 miners, had signed petitions for the Bill. At present it was impossible to get to some of the mines without going over the mountains.

A considerable amount of evidence was given regarding the effect which the construction of the proposed tramways would have in bringing about the opening up of new housing districts, the Chairman having intimated that this would be a leading factor in the settlement of the general principle of the Bill.

Mr. Nesbit, manager of the Rhondda Tramways, gave evidence in favour of the proposals, and in cross-examination said that when the proper time came, the Rhondda Urban District Council would take over the undertaking in its area at a price fixed at the time the agreement was made with it, but, of course, the fixed price would not apply to the extensions.

Mr. Stanley, engineer, gave evidence on the plans and estimates and expressed the opinion that whilst an ordinary tramway would be commercially impracticable in the district, he was satisfied that the route was suitable for railless traction. The probable receipts were estimated at £5,740 and the working expenses at £3,927, leaving a profit of £1,813, out of which, however, provision would have to be made for depreciation.

Mr. Walter, engineer, also gave evidence in support of the scheme, and, replying to the Chairman, said he considered that the roads ought to be free to every class of vehicle, or, in the alternative, all should share alike with the cost of repairs. The railless trolley system had not been long enough in existence to furnish reliable data as to its effect on the roads.

The case for the promoters having closed, Mr. G. Morgan, formerly surveyor to the Llantrisant District Council, was called for the opposition, and expressed the opinion that the road proposed to be used was unsuitable on account of its surface, its gradients and its narrowness. He believed, if the system was allowed, the cost of maintaining the road would increase by £1,000 a year.

In cross-examination, witness said he did not wish to see the Bill thrown out, as it would give more facilities for transport, but he wanted reasonable protection for the local authority.

Other evidence in opposition having been heard,

Mr. Hutchinson addressed the Committee for the Llantrisant Rural District Council, and intimated that his clients did not want the Bill thrown out. If, however, the Bill was to proceed, the promoters ought to give reasonable accommodation for the traffic, and he characterised the proposal to run six cars as ridiculous. In order to deal with the passengers 16 cars would be necessary. He contended also that the road ought to be widened at the expense of the promoters.

The Committee considered the matter in private, and the Chairman subsequently announced that they had taken into consideration the figures given in evidence, viz., £4,231, which it was calculated would provide an 18-ft. roadway and a 6-ft. footway. The Committee considered that safety would be secured by a 17-ft. roadway and a 4-ft. footway. They had come to the conclusion that the road authority must be held responsible for the adapting of the road, but they would put upon the company the liability of one-third of such capital charge, not exceeding in any case one-third of £4,000. With regard to the maintenance, they had decided

that a proportion of the annual charge should be put upon the promoters, but such a charge was not to exceed three-eighths of a penny per car-mile. Subject to agreement on these points the Committee declared the preamble proved.

Porthcawl Gas and Electricity Bill.—Lord Donoughmore's Committee on Unopposed Bills has passed the preamble of this Bill, which dissolves and reincorporates the company, and gives power to them to erect a generating station and supply electricity.

Kent Electric Power Bill.—The House of Lords has agreed to allow an additional provision to the Kent Electric Power Bill to be introduced this session.

Brighton Corporation Bill.—This Bill came before the Earl of Kintore's Select Committee of the House of Lords on Monday. Several matters were dealt with in the Bill, including a clause for the transfer of the powers of the Brighton, Hove and Preston General Omnibus Co. for the running of a system of railless trolley tramways between Brighton and Rottingdean. The borrowing powers sought in the Bill in regard to the railless trolley system were £19,000. There was no opposition to this part of the Bill, the preamble of which was declared proved.

Westgate and Birchington Gas and Electricity Bill.—The Unopposed Bills Committee of the House of Commons has passed the preamble of this Bill, which authorises an increase of capital to the extent of £45,000.

Southport Corporation Bill.—A Select Committee of the House of Commons, presided over by Mr. W. Middlebrook, has passed the preamble of the above Bill, which deals with a large number of matters affecting the administration of the borough, and, amongst other things, gives power to run trolley vehicles. The Committee sanctioned a loan of £3,500 for the electrical equipment of trolley vehicles, with 20 years as the period for repayment, and £2,250 for trolley vehicles, repayable in 10 years.

Chesterfield Corporation Railless Traction Bill.—Sir Ivor Herbert's Select Committee of the House of Commons has fixed the following periods for the repayment of loans authorised under the Bill:—Erection of car-sheds, depôts and buildings, £2,000, 25 years; overhead equipment for trolley vehicles, £33,780, 20 years; trolley vehicles, £6,400, 10 years; motor-omnibuses, £16,000, five years.

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

9,318. "Dry galvanic cells." F. Weatherill and C. Lee. April 21st.

9,381. "Electric furnace." P. Eyermann. April 21st. (Complete.)

9,396. "Hose coupler and electric signal." C. H. Light. April 21st. (Complete.)

9,430. "Night telephone-number indicator." K. S. Hay. April 22nd.

9,447. "Resistance for regulating the current in an electric circuit." M. Mansell. April 22nd.

9,449. "X-ray tubes and the like, and the manufacture thereof." C. A. Friedrich. April 22nd.

9,460. "Electrical connectors of the plug and socket type." A. P. Lundberg, G. C. Lundberg, P. A. Lundberg and G. Pegg. April 22nd.

9,463. "Earthing clips for metallic-covered electric cables." F. de B. Hart and Anchor Cable Co., Ltd. April 22nd.

9,464. "Armoured flexible electrical cable." J. Bowyer and Anchor Cable Co., Ltd. April 22nd.

9,501. "Electrical irons and the like." J. C. P. Kirkwood. (Divided application on 9,513, 1912, April 22nd.) April 22nd.

9,503. "Ampere-hour meter. Allgemeine Elektricitats Ges. (Convention date, April 24th, 1912, Germany.) April 22nd. (Complete.)

9,530. "Substitution resistances for electric lamps." W. Heins. (Convention date, October 3rd, 1912, Germany.) April 23rd. (Complete.)

9,534. "Electric controlling-switch gear." E. W. Adams. April 23rd.

9,575. "Machines applicable for use in taping articles such as cables." Fried. Krupp Akt. Ges. Grusonwerk. (Convention date, April 24th, 1912, Germany.) April 23rd. (Complete.)

9,579. "Securing electric lamps in their sockets." R. J. Bott. April 23rd.

9,587. "Arrangements for automatically regulating the conditions of electric systems." H. Loggton. April 23rd.

9,590. "Enclosed electric furnace with upper charging chutes." Helfenstein Elektro-Ofen G.m.b.H. (Convention date, April 27th, 1912, Austria.) April 23rd. (Complete.)

9,592. "Electric contacts and switching or contacting apparatus." Soc. Anon. des Etablissements L. Blériot. (Convention date, April 24th, 1912, Belgium.) April 23rd. (Complete.)

9,593. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co., United States.) April 23rd. (Complete.)

9,607. "Electric cable conduits." C. L. Drury. April 24th.

9,624. "Electric transmission systems." W. P. Thompson. (Soc. Anon. des Telegraphes Edouard Belin, France.) April 24th. (Complete.)

9,632. "Electrical signalling." J. C. Thomson. April 24th.

9,633. "Electrical driving gear for clocks and the like." F. T. Reid and C. Wiener. April 24th.

9,644. "Telephonic reproducers." C. Stille. (Convention date, April 24th, 1912, Germany.) April 24th. (Complete.)

9,685. "Amortisseur windings for synchronous dynamo-electric machines." British Thomson-Houston Co., Ltd., and F. P. Whitaker. April 24th.

9,686. "Dynamo-electric machines." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) April 24th.

9,687. "Electro-magnetic lock." H. D'E. D. Dowman. April 24th.

9,708. "Selective impulse transmitters." Western Electric Co., Ltd. (Western Electric Co., United States.) April 24th. (Complete.)

9,725. "Magnetic separating machines." H. H. Thompson and A. E. Davies. April 25th.

9,730. "Inspection elbow and like boxes for steel conduit or tubing for electric wires and cables." J. E. H. Fisher. April 25th.

9,732. "Loud-speaking telephone instruments." Kelvin & James White, Ltd., and M. B. Field. April 25th. (Complete.)

9,752. "Carrying metal-sheathed electric cables through bulk-head and similar partitions." Metal Jointing Co., Ltd., and T. Harden. April 25th.

9,767. "Conduits for electric cables, wires and the like." G. E. Carr. April 25th.

9,768. "Telegraphy." W. Judd, B. Davies and Eastern Telegraph Co., Ltd. April 25th.

9,769. "Automatic switch apparatus for electrically-illuminated advertisements and the like." M. Langer. April 25th. (Complete.)

9,777. "Copying sound records, particularly adapted for reproducing telephonic records." E. Chabeault. (Divided application on 1,444 of 1913, January 17th, 1913.) April 25th.

9,818. "Telephonic indicating apparatus." M. S. Conner and A. R. Kahl. April 26th.

9,833. "Printing-telegraphs." L. Cerebotani. (Convention date, April 29th, 1912, Germany.) April 26th. (Complete.)

9,843. "Magnetic compasses." Kelvin & James White, Ltd., M. B. Field and D. Renfrew. April 26th.

9,869. "Guards for the stay wires of telegraph, telephone, or other poles." A. Rogers-Jenkins. April 26th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1911.

Electric Transmission of Power. H. B. van Daalen and H. P. Schreiber. 24,122. October 31st.

1912.

Staples, Carpet Fasteners, Electric and like Cable Fasteners, and Similar Securing Devices. J. H. Jerrim. 1,933. July 19th. (July 19th, 1912.)

Construction of Appliance for Disinfecting Telephone Mouthpieces. A. Weintraud. 3,046. February 6th.

Telegraph Systems. H. H. Harrison, G. W. Moore and J. Savin. 5,655. March 6th.

Electrical Engine or Machinery Direction and Counting Tell-tale. J. C. Clarke and Chadburn's (ship) Telegraph Co. 5,692. March 6th.

Thermo-Electric Heating and Cooling Body. E. Altenkirch and G. Gehlhoff. 8,050. April 3rd.

Arrangement for Starting and Regulating Direct-Current Electric Motors. F. Cumont. 8,108. April 3rd. (June 29th, 1911.)

Electric Arc Lamps. A. Ogilvy-Webb, J. D. White and R. C. A. Reinecke. 8,232. April 4th.

Pyrometers. F. Rogers. 8,486. April 10th. (Addition to 6,364 of 1912.)

Method of, and Device for, Neutralising the Effect of the Inertia of Selenium Cells. A. Weigl. 8,598. April 11th.

Electrical Geysers. C. R. Belling. 8,682. April 12th.

Apparatus for Starting Multiple-Cylinder Internal-Combustion Motors by means of Magnetos. Firm of Weckerlein & Stocker. 8,986. April 16th. (October 11th, 1911.)

Device for Industrially Sterilising Water by means of Electric Mercury Lamps Generating Ultra-violet and Similar Rays. P. G. Triquet. 9,314. April 19th.

Process for the Manufacture of Drawn Tungsten Wires or the like. C. H. Fischer. 9,981. April 26th.

Prepayment Electricity Meters. C. J. Turner. 13,647. June 11th.

Conductor Rails for Electric Railways and the like. C. H. Merz and S. G. Redman. 13,801. June 12th. (Addition to No. 11,347 of 1908.)

Machines for Manufacturing Electric Incandescent Lamps. British Thomson-Houston Co. (General Electric Co.) 14,962. June 26th.

Means for Controlling Action of Electrical Alarm Apparatus for Cash Boxes, Jewel Boxes and like Receptacles. G. Downing and P. S. Moulton. 15,028. June 27th.

Electric and other Supply Meters. Allgemeine Elektricitäts Ges. 16,368. July 12th. (July 14th, 1911.)

Electrodes for Arc Lamps. British Thomson-Houston Co. (General Electric Co.) 16,707. July 17th.

Electric Cut-out Switches. L. Kovacs. 17,635. July 30th.

Electrically-operated Hot and Cold Air Douches. A. Schaeffer. 18,212. August 7th.

Wireless System to Selectively Call up Stations (without disturbing others), whether Distant Operator be in Attendance or Absent. F. Jamieson. 19,014. August 20th.

Packing-Envelopes or Packing-Cases for Electric Batteries and Cells. S. Stern and British Ever-Ready Electrical Co. 19,856. August 30th.

Prototelegraphy. T. T. Baker. 20,442. September 7th.

Automatic Device for Reversing One or More Electric Motors for Operating Tanning Tubs. Herrenschmidt & Co. 20,976. September 14th. (October 18th, 1911.)

Electrical Switches. B. D. Horton. 21,102. September 16th. (October 23rd, 1911.)

Regulators for Electric Train Lighting Systems and the like. P. Kennedy. 21,157. September 17th. (July 6th, 1912.)

Dynamos, Motors and like Electrical Machines. A. A. Price. 21,932. September 26th.

Sparking Plugs. E. H. Deligny. 22,530. October 3rd. (October 5th, 1911.)

Process and Devices for Producing in a Continuous Manner Rontgen Rays having any desired Degree of Hardness which can be Adjusted at a Moment's Notice. J. E. Lilienfeld. 23,169. October 10th. (October 10th, 1911.)

Tungsten Anti-cathode for Roentgen Tubes. Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges.) 25,052. November 1st.

Device for Automatically Stopping Electric Hoists. British Thomson-Houston Co., Ltd. (Allgemeine Elektricitäts Ges.) 26,681. November 20th.)

Armature for Direct-current Watt-hour Electricity Meters. H. E. Moul. (Korting & Mathiesen Akt.-Ges.) 27,246. November 27th.

1913.

Current-rectifying Apparatus. F. Conrad. 622. January 8th. (January 10th, 1912.)

Sparking Plugs. Siemens & Halske Akt.-Ges. 1,064. January 14th. (January 26th, 1912.)

Telephone Systems. W. J. Rickets. 2,397. January 29th. (Addition to No. 4,282 of 1911.)